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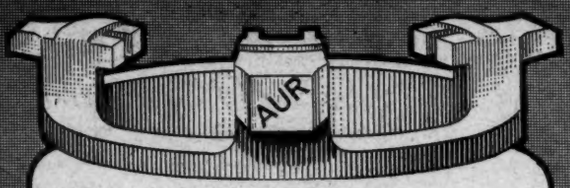

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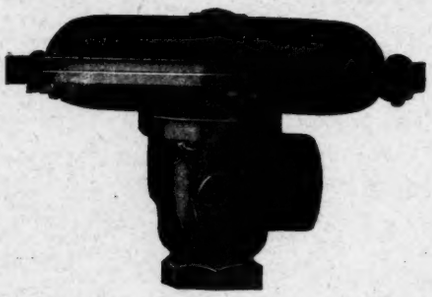

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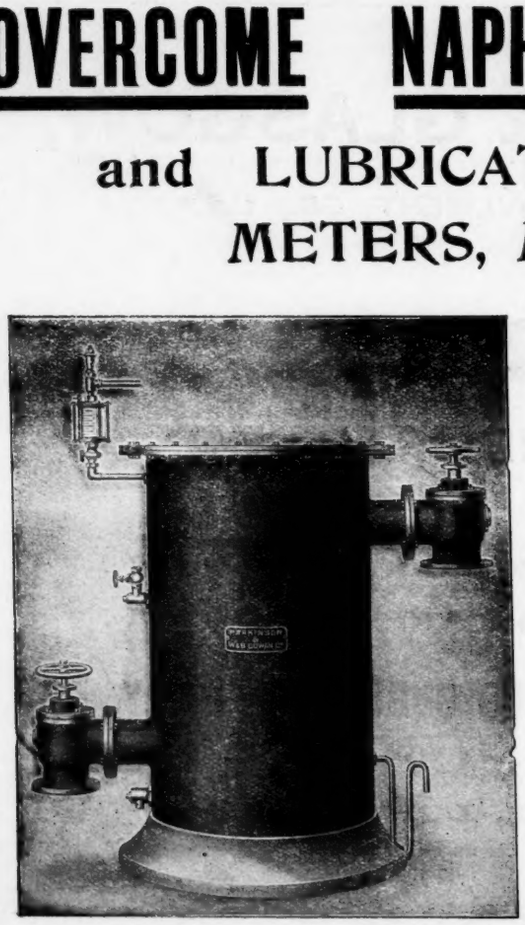

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VOL. CXLIV., No. 2895.] TUESDAY, NOVEMBER 5, 1918. [70TH YEAR.

EDITORIAL NOTES.

Reconstitution of the National Gas Council.

THE members of the Midland Association last Thursday extended their blessing to the plans for the reconstitution of the National Gas Council. It is proper that the adherence to the scheme of the chief technical officials of the industry should be thoroughly secured, as they will be very influential in bringing their undertakings into membership, and in assisting to get the machinery completed according to plan, and in early running order. The sooner the better. Germany now stands alone in the war against the civilized part of the world; and her collapse is only a question of time. From that hour all industrial and trading reconstruction matters will grow luxuriantly in importance. The gas industry must be prepared. While for it the war has had constructive effects in relation to the future, it has also brought upon it a burden of conditions which has interfered with its mobility, and has seriously assailed its prestige. It has gained in several ways; it has lost in many. There is no industry to which the terms "construction" and "re-"construction" should have greater meaning. It has to set about without loss of time making the best use of its gains; it has also to set about without loss of time repairing the mischief that has been caused it. There is no place in the present position for consideration as to whether this or that constituent part of the industry shall have superiority in any scheme for bringing into being a representative organization for the industry to look after these things. It is the industry and its affairs that have to be considered, defended, and advanced. Let this be the most prominent thought, and not be lost sight of. There was one passing reference at the Midland meeting to the status of the professional gas man. Mark this! The first thing that has to occupy our minds, our interest, and our best actions is the status of the industry itself. The higher it is established, the higher will be the status of the professional gas man. Some narrow minds think the reverse is the natural order of things; and thus they unconsciously disclose the shallowness of their intelligence.

However, there were some good speeches at the Midland meeting. There was plain speaking on the part of Mr. J. Ferguson Bell, who opened the discussion; and he is all in all for the establishing of a powerful organization to represent the industry on all matters which cannot be dealt with by organizations of limited movement and authority. The proposal is one for the mobilization of the authority of the gas industry, and nothing else; and it is being done in a way which will put power of action into the hands of the entire gas-supply industry. But there is one thing the existing National Gas Council should note. We have heard the feeling expressed privately in many quarters; it was heard again during the proceedings at Birmingham—particularly in the speech by Mr. W. M. Valon. It is a feeling that should not be ignored. It is this: The matter of the reconstitution of the National Gas Council is one which affects the whole of the gas undertakings of the country. Therefore, it would be a conspicuous mistake to think that it will be sufficient to submit the scheme at a meeting of a "National" Gas Council that the scheme itself acknowledges already suffers from defective constitution, and at meetings of the Institution of Gas Engineers and District Associations. The gas undertakings of the United Kingdom are being organized; and so the scheme ought to be submitted to them at a big meeting specially convened for the purpose, before it is finally launched. Nothing we believe would raise greater enthusiasm on its behalf; nothing would better ensure its success. It is a natural thing to do if a good welcome and prompt and substantial support are to be obtained.

In the Midland discussion, several speakers were opposed to the exclusion from the scheme of the Society of British Gas Industries; and the feeling is gaining ground—simply because there have been no openly declared reasons given—that the Society has been unjustly treated. Our own opinion, as is well known, is that there can be no complete organization of the industry without the Society; for the productions of its members are as essential to the well-being of the industry as is the commodity that is made by or used in them. What is more (this has been overlooked) we want a greater attachment of the manufacturers of gas plant and appliances at the present juncture of the industry's development than ever before. Just look back at the first report of the Gas Investigation Committee, and at the discussion which took place upon it at the Institution meeting. One of the greatest lessons is that, with the coming of a lower calorific power gas, and the utilization of combustible mixtures, the consumers are only going to realize maximum efficiencies if the appliances are capable of dealing with the more economically produced gas. How on earth is it possible for the manufacturers to keep in close touch with these movements, and to get their inspiration for improvements to fit their appliances to the gas that is coming, if they are to be kept in a sequestrated state? This (the interests of the industry forbid) cannot continue long even if, as a matter of expediency to get the whole of the gas undertakings organized, it may be temporarily necessary. The friends of the Society of British Gas Industries should bear this in mind, as well as the fact that it is freely acknowledged that the reconstitution of the National Gas Council will later bring into being a body one of the duties of which, when we are out of the meshes of the war net, will be to prepare a scheme to bring all gas organization upon a common foundation and under one roof, with each organization still looking after its own special work—the Institution, the technical work; the Gas Companies' Protection Association, the parliamentary and legal work; the British Commercial Gas Association, the gas commercial work; the Associations dealing with coke, sulphate, benzol, and tar, the bye-products; and the Society of British Gas Industries, the manufacture of gas and chemical plant and gas-consuming appliances. It would be a mistake to regard what is now being done as the end-all. It is a movement that is part of the plans for advancing and stabilizing the industry. Those who have the best interests of the gas industry at heart will do well to help the scheme through, and then the whole industry will be, when calm times are here, in a better position than it ever was to take a still bolder stride which will bring it to the final goal.

Fuel Suppliers for All Purposes.

THE coal position is continuing its forceful way. It is compelling gas engineers to learn how to make the most out of the coal they can get hold of, and how to put the maximum number of B.Th.U. into their mains, having regard to other commercial considerations. All over the kingdom gas engineers are doing things they formerly did not and would not do; and every fresh discussion shows that their new experience is not giving dissatisfaction. They would be loth to return along the paths whence they came. It would, indeed,

be very difficult to reject the ever-accumulating mass of experience with its confirmation under many different circumstances—plant and coal—that, by the aid of steaming, coal can be saved in substantial quantity, with more gas and B.Th.U. put into the holders per ton of coal, while the consumers are satisfied. These are things that cannot be disposed of by any mere hand flourish, nor can the financial economy that they represent. These are days of transition, and of new plans based on a broadened experience, which has cleared from minds much of the obstruction of custom. So the more relation of experience there is the better. There was a fresh contribution at the Manchester Institution meeting last Friday week, when Mr. Tim Duxbury opened a discussion by giving an account of what he is doing at the Oldham works in steaming the charges in his continuous vertical retorts. Though much data referring to the subject have already been published, the tale of experience was lengthened to advantage on the occasion. Mr. Duxbury has not been making progress very swiftly, but has been proceeding steadily and experimentally. This may account for the failure of his consumers to detect any radical change in the gas supply otherwise than to speak commendably of the lighting value of the lower B.Th.U. gas, and of the freedom of trouble with it. The Oldham consumers can make comparison with the gas once supplied to satisfy the flat-flame preferring local mill owners, and which gas, for incandescent lighting, heating, and engine purposes, misbehaved itself to the best of its ability.

It is coal conservation that Mr. Duxbury has in view; and what he is now doing finds good summary in this passage from his remarks: "If they took the increased "make per ton from 15,804 c.ft. in the March quarter to "22,260 c.ft. in the September quarter, it shows an increase "of about 80 p.ct. in the yield of gas per ton of coal car-"bonized, and a decrease in calorific value of from 477 "B.Th.U. to 451 B.Th.U.—a decrease of 22 p.ct." The percentages are both wrong if intended to refer to the differences in make and calorific value given in the quoted passage; and we suspect some anterior figures are required. But the lesson that Mr. Duxbury desires to drive home remains. The 22,260 c.ft. of 451 B.Th.U. gas shows that he is putting into his mains 10,039,260 B.Th.U. per ton of coal carbonized, compared with 7,538,508 B.Th.U. with the 15,804 c.ft. of 477 B.Th.U. gas, or an increase of upwards of 2½ million B.Th.U. Mr. Duxbury believes it is infinitely more advantageous to take possession in the shape of gas of as much as possible of the remnant volatile matter in coke than to leave it there. This is a point over which there will be agreement or otherwise according to circumstances; but it is clear that he cannot afford to throw away 6500 c.ft. of 451 B.Th.U. gas, because, according to his calculation, if the present results are maintained at all the Oldham works, some 30,000 tons of coal per annum will be saved. Mr. John West, it is remarked, has shed another 50 B.Th.U., and can see national advantage in supplying 450 B.Th.U. gas. The support for a higher standard is slowly cracking under the weight of experience. There was reference to steaming in horizontal retorts; and Mr. R. H. Ginman, of Leek, gave 16,200 c.ft. of 490 B.Th.U. gas as reflecting the results of his working.

This is all movement in the right direction. On economy and low-priced service, the industry has to build. With the lower B.Th.U. gas, some consumers, with their present appliances, may have to use a fraction more gas per unit of performance; and in boiling it may require a little more time. But they will have more than compensation in the fact that the price of gas must be lower than it could otherwise be sold at. And as inefficient appliances—even the inefficient domestic utensils—are displaced by more efficient ones, the small consumption and the time differences will be extinguished. As a matter of fact in some places, with the adjustment of appliances, the lower calorific power gas is credited with as good performance as the former 500 B.Th.U. gas, which points to the consuming appliances being more capable of dealing with it. In the industrial sphere, gas-engines are doing well on the lower calorific power gas; and Mr. Duxbury is fairly comfortable in the belief that he can enter into the business of supplying gas for boiler firing. He is looking ahead. But the limits to the gas industry's business are as wide as those of fuel demand; and no gas undertaking will be doing its duty that does not aim at becoming the master fuel supplier for all purposes in its own area. It may be ambitious; but why entertain an ideal short of that?

A New Phase in Technical Discussion.

There have been a couple of very regrettable incidents just lately in connection with the technical proceedings of the gas industry. In one instance, discussion of a matter of predominating importance to the future of the industry has, through a combination of exceptional circumstances, made a sharp dip into personal abuse, which every gas man, with any refinement of mind and feelings of jealousy for the dignity of the gas profession and the scientific work of the industry, must have read with prompt disapproval, and with genuine sorrow. The professional men of the gas industry must see to it that those who are devoting themselves to their work, whether through the Institution of Gas Engineers or otherwise, are protected not against fair criticism of their work, but against displays of ill-temper. Any one of us may take exception to some or all of the methods adopted in a piece of research work; but the disapproval can be expressed with a constructive view, without following it up with an attempted belittlement of the workers, which in this case has had the contrary effect, and has probably done considerable injury to the cause which the author of the attempted belittlement has been so strongly espousing, while splendidly esoteric over the details. Soon after there came the Manchester Institution meeting, at which there was a scene which must have been very distasteful to the majority of the members, and especially to the President (Mr. J. P. Leather). That a technical discussion among professional men of the industry should over one of the details sink to a level at which dogmatism and enthusiasm offer to make a bet and confidence accepts it, is something which not only those present, but gas engineers generally, will deplore. Mr. Isaac Carr has very frankly acknowledged to the President his error in yielding to the excitement of the moment, and has expressed his regret for the part he took in the unseemly incident. We welcome for publication the letter which he addressed to the President, and which appears in another column to-day.

If gas engineers cannot keep their technical proceedings free from such exhibitions of feeling, we are afraid the position of the gas profession will not be enhanced in the eyes of associated branches of engineering, nor, in short, in the eyes of anybody who happens to learn of these doings—in fact, their continuance would soon qualify the gas-engineering profession to be regarded as a sort of oddity among its equals. We believe fully in freedom of speech and writing in technical discussion; but freedom does not mean excess, nor does it make permissible personal abuse. Every man has a right to his own opinions on any subject. Even the working man claims the right to the opinion that his beer now contains "more arms and legs than body." The gas consumer, like Sir Dugald Clerk, may prefer—and he has a right to prefer—to have his gas (as nearly as possible) all combustible body, and containing merely the unavoidable "arms and legs." Every gas engineer has the right to his individual views as to the character of the gas of the future; and however assertive the opinions of another engineer, they need not move him the least bit. If their soundness persuades him, they make fair conquest. All gas men are now out for one and the same purpose. They know the demands of the country are for the gas that will be the cheapest, having regard to good service for all purposes—not for any single one. And cheapness will be effected by the securing of the largest possible economy and efficiency per ton of coal, and per unit of manufacturing, storage, and distributing plant. There are before the gas profession various plans for deriving greater economy; but investigation has not gone to the length at which it is wise to discard any proposal until there is complete justification for so doing. Gas engineers are not going to finally pin their faith to any method upon the *ipse dixit* of any one individual; nor will they do so until it can be said positively that the position is perfectly enubilated, and that the direction of the line of policy has been made positively plain. While this work is going on, let every effort be made not only to maintain but to raise the quality of the industry's technical discussions—whether oral or printed—and not to allow them to be degenerated by the introduction of incidents uncongenial and repugnant, with possibly few exceptions, to the men constituting the gas profession. By no means let it be assumed that we have adopted the rôle of censor of manners. But in these days, when matters of the gravest moment to the industry are in a state of flux, it is important that those things should not be done which will stifle work and discussion, or cause men to refrain from participation.

To Strengthen the Gas Companies' Protection Association.

THE fact that the annual meeting of the Gas Companies' Protection Association last Thursday was the twenty-first, and that the organization had reached its majority, apparently temporarily escaped the notice of the Chairman (Mr. H. E. Jones), who is usually very keen in making mental note of points which will come in handily for his public speeches. During its twenty-one years of existence, the Association has done much to help make history for, and to advance the interests of, the industry—in Parliament and elsewhere; and it has been indispensable. No other hitherto existing organization could have done in all respects precisely the same work. To watch parliamentary proceedings and legal developments, and, in connection with the former, to take proper action and at the right time, require not only an organization but people in it with trained minds, specialist qualifications, and very intimate contact with such matters. In this organization, gas companies, and for the matter of that too the industry generally, have a sort of parliamentary watchdog, that searches in all the highways and by-ways of new introductions into Parliament to see if in any place the interests of the industry are affected. A big industry like that of gas supply, could not, in these fast moving times, do without an organization of the kind, and particularly will this be so when legislation is proposed after the war to give effect to some of the countless recommendations that have been made to the Government. Though the Association only includes gas companies, local authority gas departments also benefit largely from its work. History tells this. There comes to mind the tussle over the sulphur restrictions, the Carpenter burner, and several inquiries of comparatively recent date in which the Association have with advantage intervened. Most of the questions have been of a character which concerned gas undertakings as a whole, and not those of one particular ownership. Therefore, so far as these general questions are concerned, the local authority undertakings are as well off by non-membership as (if eligible) they would be by membership. There are, however, other matters taken up by the Association in which gas companies find themselves up-against the municipal authorities—not municipal gas departments. Therefore, whatever happens in connection with the development of organization in the gas industry, gas companies will still find it an advantage to keep the Association alive in some shape or form—notwithstanding the presence of the National Gas Council. While the Council has a large field of action by embracing, irrespective of ownership, all gas undertakings, its very composition prevents it going where the Gas Companies' Protection Association can move with the utmost freedom.

However, there are some people who think the Association requires strengthening, and having the area of its work broadened and lengthened, having consideration to its relations with other organizations. In accordance with prevalent custom among organizations, the Association has appointed a Sub-Committee to examine its organic structure and functions, and to report. The Chairman is evidently now wondering what the Sub-Committee will have to say, because he cannot see that there is much the matter with the constitution of the Association, except that he would like a greater number of undertakings to become members. At the present time there are only 147 undertakings represented; but the number includes practically all the chief companies. What the Chairman thinks is much the opinion of some of the other members, judging from the little open suggestion that is made for improving the organization. At the meeting the only proposal advanced for improvement had nothing to do with the constitution, but only with the title. Mr. H. C. Head does not like the word "Protection" in the title. There is something in what he says; there is also something to be said against its abandonment. "Pro-"tection" savours somewhat of a Trade Protection Society; and the suspicious public always fancies it detects collusion to its disadvantage going on behind the barred doors and the shuttered windows of protective combinations. On the other hand, the Association does not come in contact with the public; and those associated with parliamentary matters interpret "protection" as being something of defensive character. However, after twenty-one years' existence, a little introspection and perhaps overhauling should not be amiss; and at the same time there may be members who—Mr. Charles Carpenter, D.Sc., it was recently seen, favourably views the possibility—consider that something might be done to extend the scope of the Association's work. Perhaps there is; and any increased usefulness, without at all trespassing upon the domains of the other organizations, would strengthen the Association, as would also an extension of the membership.

There is one direction in which improvement might be effected; and that is in respect of the election of the Committee. The elections have been of rather a haphazard character; being personal rather than representative of gas companies in the different areas of the kingdom. Read in our report of the proceedings what took place last week in connection with the re-elections and new elections to the Committee; and the point will be clear, as will also be the fact that chance, and not system, has a great deal to do with the filling of vacancies. It is now so well recognized that it is being introduced in most organizations with membership drawn from all parts, that representation on councils or committees should have a territorial basis, so that the views of all concerned wherever situated may have expression, and the council or committee be in direct touch with its far-flung constituency. If the Committee were remodelled with this in view, the Association, we feel sure, would draw in companies who have hitherto declined to unite in its work. Perhaps this is a point the investigating Sub-Committee will consider. Meanwhile, though every one of its twenty-one years has not been productive of imposing work, we have to view the history of the organization as a whole. So viewing it, its successes and proved utility must have our warmest congratulations.

The Simultaneous Extraction of Benzol and Naphthalene.

THE paper that Mr. Harold E. Copp read at the meeting of the Midland Association last Thursday is headed "Notes "on Benzol and Naphthalene Recovery;" but the author did not, as the introductory paragraphs show, altogether confine himself to the limits suggested by the title. After these paragraphs, an account is given of certain troubles experienced with his benzol and toluol plant and with the tar-dehydrating plant, which is so designed that it is capable of producing wash-oil from tar as well as treating the spent wash-oil for its rectification. The difficulty with the latter plant was when it was being employed for the rectification of the wash-oil. The paper describes the nature of the difficulties, and how Mr. Copp successfully dealt with them. But it is in the tail-end of the communication that the largest interest is found; and, though Mr. Copp has lately learned that the Germans have done something aiming at like effects, this does not detract from the ingenuity that he has personally shown, and the remarkable results he has achieved, which appear, oil-washing notwithstanding, to have not only relieved him of naphthalene troubles (other than from old deposits) in a remarkably brief space of time, but have produced collateral advantages in other directions. What he does is to remove naphthalene from the gas in conjunction with the extraction of the benzol, so that its ability to trouble is permanently annulled. In other words, the washing creosote performs the double function of removing the benzol as well as the naphthalene. To separate the naphthalene fractions from the crude benzol, a small supplementary condenser has been installed between the still and the main condenser. In this new member, a very fine regulation of temperature has to be ensured; and this is realized by its smallness and structural details. The treatment that the liquid from the small condenser undergoes is described in the paper up to the point where the naphthalene is obtained in the form of pure white crystals, and is bagged for sale. To the description gas engineers will be attracted by mention of the one fact that, while the crude gas at the inlet of the oil-scrubber contains an average of 16·8 grains of naphthalene per 100 c.ft. of gas, since the supplementary condenser was first brought into action, the scrubber has absorbed the whole of the naphthalene in the gas. From 24 to 30 lbs. are recovered every day; and this is the equivalent of 16 grains per 100 c.ft. The remaining 0·8 grain passes with the crude benzol to the storage tank. Since the introduction of the small condenser, the wash-oil has only contained 6 p.ct. of naphthalene; and it is kept in better working condition, and lasts longer. The quality of the benzol, too, which formerly averaged about 51 p.ct., has now risen to a regular 71 p.ct. The working of the purifiers has also been improved; the material showing no signs of

the presence of naphthalene. Since the process was started, no vaporized oil has been introduced into the gas. What trouble there is now with naphthalene appears to be—and must be—solely due to old deposits. But with naphthalene free gas going out into the district, naphthalene complaints should soon be entirely a thing of the past. The changes in gas-works practices that have been effected by the war permit us to describe, without any qualification, Mr. Copp's paper as a most valuable one to the gas industry, which can give hearty welcome to any easily applied method of permanent relief from the additional burden of naphthalene trouble due to the extraction of benzol from its gas.

Confidence of Parliament Wanted.

With much that Sir R. Vassar-Smith said in his Presidential Address at the annual meeting of the Federation of British Industries last Wednesday gas companies will most warmly agree. Of course, it is obvious that State control of industries cannot come to an end with the ringing of the peace joy bells; but it should be ended as soon as possible. In the opinion of Sir Richard, it is a vital necessity that there should be, after the war, not State interference but State assistance. The gas industry will cordially endorse this view. It has a life-long experience of State interference, and of how it has hampered progress; and it is now under such complete control that it feels it has hardly a soul to call its own. Another declaration which is highly acceptable is that "manufacturers must demand a greater measure of trust from the Government. They cannot submit to the dictation of the State as to the conditions and the development of industries to which their whole thought and energy have been devoted." It is certain that unless Parliament in future reposes a greater measure of trust in the gas industry, and refrains from treating its responsible men as but little better than rogues, a grievous wrong will be done to progress and to national interests. The industry asks for fresh confidence and for greater liberty; but it will be satisfied if there is a thorough investigation of its work by competent men before any additional confidence and liberty are conferred.

Sulphuric Acid Makes Another Advance.

There was some time ago the semblance of assurance that the prices of sulphuric acid had reached top figures. But the periodical flight of prices declares that any confidence in this direction has been altogether ill-founded. Only on May 10 last an Order was made raising the prices; and now another Order pushes them up still further as from last Friday. The jump is not so great as in May for the acids up to 90 p.ct.; but it is not welcome. Last May we had Class "A" arsenical acid elevated by 13s. to 83s., and Class "B" non-arsenical or de-arsenicated acids, by a similar amount to 98s. Now the former is raised by an additional 5s. to 88s., and the latter by 7s. to 105s. The more concentrated acids of strengths of over 90 p.ct. have in Class "C" arsenical acid had their prices advanced at increasing stages of strength by from 10s. 6d. to 12s. 9d. per ton; while Class "D" de-arsenicated or non-arsenical acids have gone up, similarly according to strength, by rates varying from £1 6s. 3d. to £1 11s. 6d. per ton. Under the arrangement entered into last year, makers of sulphate of ammonia are allowed an extra 11d. per ton for every 1s. increase in the price of sulphuric acid; but the farmers will blame the sulphate makers for the advance, the same as some gas consumers blame the makers of gas for its current price. Yet the gas industry is wholly helpless.

Unmuzzle the Street Lamps.

It is thought in some quarters that the chances are now remote of enemy bombing aircraft paying night or any other visits to this country. That is quite a fair belief; but while victory is now assured to the Allies, uncertainties and risks must accompany to the end such a war as this. Our contemporary "Municipal Engineering" considers the time has arrived when it is imperative that the restrictions on street lighting should be removed. Some of them could be, but not in their entirety. A new power has arisen. The Coal Controller wants to save fuel, and so, until he can say he is well out of the wood, he will not consent to an increase of consumption in order to provide more street lighting. But something could be done in unmuzzling part of the lamps which are costing as much in consumption as, and more in total money than, in pre-war days, but have their possible illumination depreciated by some 80 to 90 p.ct. through the process adopted to subdue or diffuse their actual power.

Light Economy in Hotels and Shops.

That the Coal Controller would not be a party to increasing street illumination, if it means more fuel consumption, is pretty clear from his fresh decision to reduce further the lighting allowances in hotels, restaurants, and the large shops in London and the big provincial centres. There is to be, for the time being, no more extravagant display lighting or excessive illumination for the purposes of advertising or of attraction. The Controller has been spying out the land; and he is convinced extra economies can be made. He is therefore going to trim the scale of allowances by a further 25 p.ct., subject to the consideration of any special circumstances. Managers of the hotels and restaurants ought to be grateful for this enforced economy; for their lighting bills—lighting exceeding the bounds of usefulness, and trespassing largely on the grounds of luxury and foolishness—must in cases be enormous ones. It is always a puzzle why, in many places which otherwise show refinement, the illumination should fall on the grossly gaudy side. With the electric light, it may be due to advice tendered in the interests of the electricity station, for good, long-hour lighting consumers, paying top figures per unit, are very desirable from the station standpoint. A large number of the most prominent traders in London have agreed as from Nov. 11 to reduce the amount of their shop illumination to one-half the number of lamps used in 1917. The Coal Controller has got to a point where he heartily believes in the principle that every little helps.

Oil Exploration.

The schemes which are to result in a new England embrace one which shall make it less dependent upon outside sources for oil. Coal and shale carbonization could never produce all the oil that is required, because of the limitations set by the demand for the primary products. At best, coal and shale carbonization can only contribute a part. However, the whole of this oil question was raised by the needs of the war; and, as the war is in the position that it is in to-day, it is not a little difficult to understand (while admitting the value of the work) the rush of the Government at once to set about surveying the country by means of borings to ascertain whether or not Nature has been benevolent to it in regard to subterranean oil supplies. The first boring has recently been started on the Duke of Devonshire's property at Handstoft, near Chesterfield; but there is little possibility that, if it turns out a lucky venture, it will be contributing anything of material value to our oil supplies for the next—what shall we say?—eighteen months or two years. It therefore rather seems that those who are assiduously hastening the Governmest along in this matter are doing so—not for war purposes, but for some other reason. Probably the real one is that they are afraid they will not find the Government so accommodating after the war as during the war. In fact, in some quarters, the view appears to exist that there is more in this haste than is visible to the naked eye; and there are insinuations that all is not so creditable as it should be. The "Saturday Review," in its issue for Oct. 26, makes some rather caustic comments upon the matter. Meanwhile, the Petroleum Production Bill has had a second reading in the House of Lords. This prohibits persons other than the Crown from searching for or getting petroleum within the United Kingdom—the Government reason for promoting the Bill being that, if petroleum exists in England, it should be properly protected, and not be allowed to be wasted by indiscriminate boring, as has been the experience in oil-producing countries. The Duke of Northumberland has also a Bill before the House, one intention of which is to see that the owners of the land obtain some reward. In other words, it again raises the controversial question of royalties—not fixed, but indefinite ones, though not called by that name. The royalty question was the death of a former petroleum exploration measure promoted by the Government; so that, when the Duke's Bill gets to the House of Commons, it may experience some rough handling.

The late Mr. Thomas Berridge, of Leamington, left estate of the gross value of £9346; the net personalty being £8791. Sir Robert K. Inches, of Edinburgh, left personal property in the United Kingdom valued at £94,153.

INSTITUTION OF GAS ENGINEERS.

GAS INVESTIGATION COMMITTEE.

Discussion on the First Report [see *ante*, pp. 235-49], dated May 9, 1918, of the Research Sub-Committee appointed by the Gas Investigation Committee of the Institution, together with Supplementary Matter, Aug. 9, 1918.

The PRESIDENT (Mr. Samuel Glover, of St. Helens), before calling upon Prof. Smithells and Prof. Cobb to introduce the report, said: I consider that I ought to explain in a few words something of the history of this undertaking by the Council of the Institution. In 1917, the Council were led by certain statements which were being made to decide that it would be in the interests of the industry if a systematic inquiry were set on foot to determine the lighting and the heating efficiency in actual practice of different grades of gas, and especially of the grades which had been called into use by the exigencies of the war. For, although there existed a good deal of information and a good deal of confident opinion on the subject, it was evident that the whole matter had really never been as fully and systematically investigated as was desirable. Having arrived at this conclusion, the Council directed that the task should be undertaken by the Committee who had been working at Leeds on the subject of heating and ventilation. As this Committee was composed of gas engineers and representatives of the University of Leeds, it was decided that this new work was of most urgent importance; and they were requested to take up the new work, and forthwith proceeded to plan an investigation and make the necessary preparations for carrying through the work.

This took place before the Government had constituted a Fuel Research Board under Sir George Beilby, F.R.S. Soon after the creation of the Fuel Research Board, the Board of Trade called a meeting of representatives of the gas industry, including the Gas Referees, Technical Societies, and gas consumers' representatives, to meet Sir George Beilby with a view to his eliciting opinion as to the quality of gas supplied to the public, especially with respect to the proportion of inert constituents. At this meeting, it was revealed that it was easy for some of the interests represented to give their opinion with definiteness as to what they wanted and what they did not want. But representatives of gas manufacture felt themselves quite unable and unauthorized to make definite statements on so highly controversial a subject, and one on which the Institution of Gas Engineers had initiated an experimental inquiry with the object of obtaining reliable data which they believed to be lacking, and yet to be essential for the formation of a sound judgment. As the question of the type of gas which, under existing and impending circumstances, it will on the whole be best to aim at supplying for all purposes is a very complex one—involving much more than the Council had referred to the Heating and Ventilation Committee—the Council appointed a larger Committee, under the title of the Gas Components Committee. This Committee, whose name has given rise to some misunderstanding, was renamed the Gas Investigation Committee, and it incorporated with itself, as a Sub-Committee, the Committee which was already engaged in experimental work upon the heating and lighting efficiency of different grades of gas. The Sub-Committee have from time to time reported to the Gas Investigation Committee; and although their inquiries are by no means completed, it was felt by the Council that, having regard to the subject of the inquiry, they might with some advantage make known to the members of the Institution the general character of the results so far as they go. The preliminary report—I desire to emphasize here the preliminary nature of this report—of these results is to be open for consideration this morning; and it is an account of these results that Prof. Smithells and Prof. Cobb will deal with.

The President of the Institution, who is Chairman of the Gas Investigation Committee, acts as sponsor of the Committee's report, and is hopeful that the Committee's work, when finished, will enable Parliament to pass a new Act which will be very helpful to the great gas industry and to the nation as a whole. Yet another very important branch of work has been undertaken by the Committee in addition to that which is being done by the Sub-Committee, and that is an investigation of the work and results obtained at the Uddingston Gas-Works, which works have been offered for our use for this purpose by the kindness of the Gas Company, and of their Engineer, Mr. Lawrence Hislop.

Lieut.-Col. Arthur Smithells.

Lieutenant-Colonel SMITHELLS: I have the honour to be Chairman of the Research Sub-Committee of the Gas Investigation Committee; but am afraid I have no right to be. You will readily understand that my military duties keep me very fully occupied. It is only in the scantiest leisure that I can give the least attention to anything else; but I should be reluctant to fall altogether out of your ranks, even if I can do no more at present than mark time. I am sincerely glad when, at rare intervals, I can do a hand's turn to aid the important work of the Research Committee. Fortunately, there is Prof. Cobb, well able to fill my place and his own. To him I leave the real business of giving an account of the Sub-Committee's work—confining my remarks to one or two general questions.

In the first place, I want to say that it is not without some apprehension that I see our results being published; and I wish to ask from everybody strictly fair play. So far as good-will is concerned on the part of authorities—governmental, industrial, technical, and educational—there has never been so good a time as the present for initiating scientific investigation. So far as many other things are concerned, there has never been so bad a time. The difficulty of finding qualified chemists in adequate number, and of getting the necessary appliances and materials, is very great. In such circumstances we are asked to make a scientific inquiry at express speed into a very important industrial question. I can only say we have done, and are doing, what we can. We are in no need of instruction as to what we have not done or might have done—we know that well enough. What we should value is any indication of means to do more or better work, in addition to close criticism of what we have done. The Committee have had to narrow their work at every turn, in order to economize time; and they have been obliged to keep out of what seemed by-paths of the immediate track they were asked to follow, however attractive and promising these bye-paths may have seemed. One thing I hope may be acknowledged, and it is that our conclusions are stated with that strict fairness, fulness, and impartiality that are the very first obligation of all scientific workers.

I feel bound to utter a word of warning. It is the easiest thing in the world to make a wrong use of such results as are now being published. They may be taken in selected bits, they may be exaggerated, and they may be perverted to suit the prejudices (both conscious and unconscious) of people with strong views or strong interests. I should like to say that this is unlikely to happen. I know, however, that such things do often happen. There never was a time since I have known the gas industry when its future course needed so acutely as it does at present the co-operating thought and effort of its wisest men. It should be, and is, strong enough to determine its own course and to resist all unfair domination. In this good work, I need hardly say that those of us in the scientific world who have become attached to you, will gladly do our best to make science useful to you.

The last thing I have to say is that, notwithstanding the difficulties to which I have alluded, our course has been attended by some marked good fortune. Through the instrumentality of Mr. E. W. Smith, D.Sc., we have been favoured by having at our disposal the experimental resources at Birmingham. Mr. Hislop is also giving us facilities of the greatest value at Uddingston. We have been extremely fortunate in our Research Chemist, Mr. James Wood; and I am sure all the members of the Committee would wish me to take this opportunity of expressing their high sense of the skill and devotion which he has brought to bear on the work.

Prof. John W. Cobb.

Prof. J. W. COBB: In the first place, I am quite certain tha you will believe me when I say that Colonel Smithells has belittled unfairly the share that he has played in the work of the Gas Investigation Committee, and particularly the Research Sub-Committee. He has been present at nearly every meeting (often at great inconvenience to himself), has displayed throughout the keenest interest in all that has been going forward, and has been most helpful in many ways. I might say more under this head; but to the Institution of Gas Engineers I believe this to be altogether unnecessary. In introducing the report, as Chairman of the Research Sub-Committee, Colonel Smithells has made quite clear the position of the Committee with respect to this investigation. I should like to endorse all that he has said in this connection; and to add, with your permission, some further explanation of what we have attempted to do. Our original proposal for this inquiry was made at the end of 1916. Since that time its importance has become more obvious every day. The necessity for the conservation of our fuel resources, and the more complete utilization of the thermal, and also the chemical, value of coal, is now receiving Government recognition; and the working of the carbonization process with the maximum degree of efficiency is one of the most essential parts of any such conservation. It is very necessary, therefore, that the gas industry should know what are its most efficient and economical methods, both in production and utilization, and (what is equally important) should be as far as possible free to develop these methods. This has not been the position in the past, while the industry has been carrying the dead weight of standards fitted to the conditions of other times. But we hope better things for the future.

In the first place, however, the gas industry should itself be able to make definite statements as to what is the quality of gas which combines best the two qualities of economy in production and efficiency in utilization. The work which the Research Sub-Committee set themselves was the determination of the relative efficiencies of different grades of gas in use. We believe—and the belief is firmer than ever to-day—that, although confident statements might be made by individuals on this subject, there was no consensus of opinion possible unless and until careful comparative experiments gave some firmer basis for it than any which was

in existence. Our inquiry has been limited, on account of time, to the investigation of gases which might reasonably be regarded as coming in the range of gas-works practice; and the tests have been carried out on what we regarded as representative of existing appliances. I cannot emphasize this too strongly, and hope that our report will be read with this proviso in mind.

The first part of the work (on methods of testing) was carried out in the University laboratories at Leeds. The second part has so far been carried out at the works of the Birmingham Corporation Gas Department. They have given us every possible facility and assistance; and our thanks are due to them and to Mr. E. W. Smith, D.Sc.—their Chief Chemist, and a member of our Committee. But in these times, however willing a works may be to do all that lies in its power, very much is impossible which under normal conditions would be comparatively easy. I say this because it would be unfair to Mr. James Wood, our Research Chemist, if I did not lay stress upon the difficulties which he has had to overcome from day to day in carrying out the work. That he has made such progress is a great testimony to his perseverance, ingenuity, and resource. In my own position, as entrusted with supervision, I have had a very special opportunity for realizing this, and should like to say so, and to declare how very completely, in my opinion, Mr. Wood deserves the confidence which I know the Committee place in his work. He will give us an account of the work itself; but I may indicate one or two points.

We tested both low-temperature and high-temperature uses of gas, taking as three types of apparatus in use the ring-burner, the gas-fire, and the incandescent mantle, which among them cover a very large proportion of the gas consumed. I think we were all rather surprised to find the extent to which the efficiency in use of the gas-fire, and even more so the ring-burner, was dominated by the number of calories supplied to it, and how little it was affected by the grade or composition of the gas. I may here say incidentally that it does appear as if very slight alterations in one or two of the gas-fires that we tested would greatly increase their capability of dealing with a wider range of gases in use. With respect to lighting, nearly all our tests have been made on the upright incandescent burner; and in this application, the grade of gas seems to have a much more marked effect on the efficiency obtainable. Our results bring out, among other things, the insuperable difficulties that would arise in applying, as a criterion of quality, the flame temperature, which has been so often recommended. In the first place, the richer gases require more air for their combustion; so that the difference between the mixture of gas and air ready for combustion from one gas and that from another is nothing like so great as that between the two original gases. The chief difficulty, however, arises from the composite character of the flame and the fact that the illuminating power of a mantle depends upon the intensity of combustion, not of the flame as a whole, but along the particular thin shell mapped-out by the mantle itself. The temperature of the flame, therefore, comes to be of minor importance over a wide range compared with the power the flame possesses to fit the mantle and so exert its maximum effect. My own personal impression is that the best definition of the quality of gas all round will be made simply in terms of its gross calorific value per cubic foot; but I would emphasize that this is an individual impression, and that the report itself is of a preliminary nature. We have still much to do. Apart from clearing-up one or two points of uncertainty in connection with the appliances already mentioned. The inverted burner, the gas-engine, and industrial furnaces require attention. It is plain that, when they make any recommendation as to standard, the Gas Investigation Committee will have to take into account the efficiency of gas in all its chief applications as well as the economy of production.

I should finally like to call your attention to a subject which does not form part of the report before you, but is closely connected with it. We have been concerned so far with the efficiency of gas in use; but comparative economies in production—the efficiencies of various gas-making processes—are of equal importance. This is a different line of investigation which can, and should we believe, be followed up separately and without delay. The construction, for publication, of comparative financial balance-sheets for different processes and apparatus is a matter of great difficulty; but it seems to me that technical or material balance-sheets likely to be of great value to the industry can be prepared. Any individual, firm, company, or authority can attach costs in accordance with the conditions. Your Council have authorized the appointment of a second Research Chemist for this purpose; and though it has been a difficult matter to secure the services of the right man for the purpose, we believe that we have succeeded. It is proposed to start this branch of work at Uddingston, where, through Mr. John West, valuable facilities have been offered by Mr. Lawrence Hislop and his Company. The Research Sub-Committee have co-opted Mr. Hislop, and will have the great advantage of his collaboration while the work is being carried out at Uddingston. This should be of great service to us in enabling us to investigate gas production in continuous vertical retorts, and those developments of carbonization which depend upon the treatment of the descending charge by an ascending stream of gas and seem so promising in several directions.

Mr. J. M. Wood.

Mr. J. M. WOOD, M.Sc., the Research Chemist, then explained the contents of the report.

Sir Dugald Clerk.

Sir DUGALD CLERK, D.Sc.: I have listened with much pleasure to the opening of my friend Colonel Smithells, to the address of my friend Prof. Cobb, and to Mr. Wood's summary of the report. The subject is a most important one, because the whole range of the use of gas—except perhaps for motive power—has been touched upon. The greatest proportion of gas is now used for heating purposes. I believe that, throughout Britain, if one took the average of the amount of gas used for different purposes, it would be about 35 p.ct. for lighting, 55 p.ct. for heating, and only about 10 p.ct. for power. Power is by far the lowest. It is obviously therefore of great importance to deal very fully with both lighting and heating. With regard to the qualities of gas, however, perhaps I had better speak first on my own subject—the internal combustion engine.

Of course, town gas was the original gas used in all gas-engines. In fact, the name arose from the coal-gas engine; and coal gas is a very good fuel indeed for gas-engines. But in the old days we used low compressions; and with low compressions coal gas is extremely satisfactory. It is found, however, that if you are dealing with coal gas for motive power for gas-engines, the higher the calorific value, the lower is the compression with which the engine can work. If you take the coal gas we had just before the war, we gas-engine builders usually adjusted our engines for what we called a compression ratio of 5 to 5½. At this compression, we had a very high brake efficiency—as high as 30 p.ct. of the heat value of the gas. We, however, also desired to try higher compressions, but always found that, if we went above 5½, we at once troubled ourselves with pre-ignitions. This did not greatly matter, so long as the engines were small as they used to be; but when we came to build engines ordinarily made now by such companies as Crossleys and the National, which go up to 3000 H.P., if we have to use coke-oven gas, we have great difficulty. In fact, we have actually to add to the coke-oven gas a certain proportion of cold exhaust gases, for the sake of the carbonic acid, so as to lower the flame temperature in the cylinder, and so reduce the liability to pre-ignition. I am pointing this out, because I want to say that, so far as we are concerned, what we want is a certain number of heat units for our money. We do not mind inerts, so long as we do not pay for them; but we do not want to pay for heat units whereas we are getting nitrogen and oxygen, which we can obtain from the atmosphere without paying for them. We are perfectly willing to pay for heat units; and with them you are quite at liberty, from the point of view of the gas-engine people, to introduce even carbonic acid, because it has what one gentleman called a poisoning effect on pre-ignition; and you can get high compression with the engine running quite smoothly. I am very pleased indeed, from the gas-engine standpoint, to see that the calorific value of the gas is coming down, because it makes it much easier for us. We do not want too much hydrogen and we do not mind a little carbonic acid, so long as you give us the heat units required at a reasonable price.

When one comes to deal with the subject of the incandescent burner, that is, notwithstanding all that has been said, essentially a question of flame temperature. I think Prof. Cobb has rather erred in his definition of flame temperature. I am quite with him when he says it does not matter for the temperature of the bunsen flame as a whole. It is perfectly true that it does not matter for the temperature of the part of the flame not in contact with the mantle; but it is absolutely essential that you should have a gas capable of giving a high flame temperature. You may not require to develop it throughout the flame; but you must have the capacity for giving flame temperatures of the order of 1500° or 1600° C., at least.

I would suggest to the gas industry that another test be applied to gas for your own benefit—not an official test. If you take a mixture of any gas and air, getting just the proper proportion of oxygen present to burn all the gas in the mixture, and determine the maximum pressure on explosion by an electric spark with an indicator, then you have the conditions—if the gas and air are properly mixed—under which you are really testing the flame temperature of the gas; and that is the flame temperature which Prof. Cobb will find (if he experiments as I have done to some extent) really matters. You must have a gas that can give the maximum flame temperature at the right place—and that is the mantle. One very great difficulty is that, according to the previous aeration of the gas, the nature of the flame varies; and the same mantle does not fit the flame. Then, of course, you may have as high a flame temperature as you like; but if it is not in contact with the mantle, you cannot get the light which depends upon temperature. As radiation is proportional to the fourth power of the temperature, a very small relative rise is extremely important. I should here like to impress upon you that flame temperature defined in this way is really of the essence of success in incandescent lighting. We cannot get incandescent lighting with weak producer gas of 140 to 150 B.Th.U., which is extremely good for the gas-engine. So long as you have thermal units at all, the gas-engine man can make use of them. He rather prefers a flame temperature of about 1300° C.; but it is vital in the case of incandescent lighting to have the flame temperature high and at the proper place—where the mantle is ignited. I notice that the best result of Prof. Cobb and Col. Smithells, so far as their experiments have been conducted with inverted mantles, is about 13 candle power per cubic foot of gas consumed.

The PRESIDENT: Upright mantles.

Sir DUGALD CLERK: I meant upright. They have been working with upright mantles, and they got about 13 candles per cubic foot. It is well known that you can obtain about 25 candles, and more if you apply pressure. I have made experiments with high-pressure inverted lamps, in which the figure was carried up to between 40 and 60 candles.

If we now consider the future, I should say that where the electricians are likely to compete more strongly in the future is in lighting. Though one must remember, as against all electric distribution of energy, that with even the highest efficiency turbine, they start with a loss at the central electric station of 80 p.ct. of heat under their boilers and in their turbines. The present station loss is much higher—93 p.ct. loss and only 7 p.ct. energy for distribution as the average of the United Kingdom. In the best case still in the future they have only to deal with 20 p.ct. But in electric lighting the original method of incandescing the filament so accurately passed the heat to the exact point where it was required, that you got very good results from a small amount of heat. It is necessary that you should get the best results with inverted incandescent mantles; and in British thermal units required at present, you are rather better than the best result in electricity distribution with a higher local efficiency. But so far as the country is concerned, it is interested in the amount of fuel that is consumed under steam-boilers or otherwise; and therefore you have always, in all these comparisons, to go back to the gas-works for the efficiency of gas production, and to the generating station for the efficiency of electricity production. This being so, you will find that with an inverted incandescent mantle you have a great advantage in the present efficiency of lighting throughout the country as compared with the present consumption of fuel by electrical undertakings, which the Coal Controller was good enough recently to give me. In your incandescent lighting you are considerably better than they are.

With regard to heating, I was delighted to find that the efficiency of the ordinary ring-burner is over 50 p.ct. in many cases. It says a great deal for gas. In heat supply you are overwhelmingly superior to electricity, which is the most wasteful thing you can introduce for the supply of heat from a central station. But you, I fear, have been so very confident of your enormous superiority over electricity in efficiency of production and in distribution of heat, that that attention has not been given which may still be given to raising the efficiency in use. I should like to see a higher efficiency than 50 p.ct. I do not think there is any difficulty, if you really pressed it on the manufacturers, and would not take such a burner unless it did give a higher efficiency. You should get a Committee together, and prepare a set of standards, and make the manufacturers come up to it. You should be able to get up to at least 70 p.ct.; and with that you would have a great superiority in connection with all heating. With the gas-fire, you must not confine yourselves absolutely to radiation, because a great deal of the heat of all fires comes in by convection and conduction as well. You may have 50 p.ct. efficiency in radiation, and then, allowing for some loss at the back of the fire, you have about 15 p.ct. more which comes in as conduction and convection. This makes a total heating efficiency of 65 p.ct. so far as the room is concerned. And when the electrician comes and talks about 100 p.ct. efficiency in the room, it is just as well to have a figure like this to show him. You can have 100 p.ct.; but it is in a room without any ventilation.

With regard to furnace work, of course, there is a point at which the electric arc begins to have the advantage. If you take any ordinary coal gas such as we used formerly to have—say, 550 B.Th.U.—the maximum temperature possible was nearly 2000° C. It will be quite obvious that if you are going to heat up a mass of steel during melting and treatment to a temperature of about 1500° C., and have a gas giving no more than 2000°, you have only 500° difference at the top, and so would work under very difficult conditions. The electric arc goes to 3000°; and consequently for some forms of melting the individual efficiency is very high. But when you come back to the turbine or the generator, you find that all the efficiency is gone; so that the very high electric arc efficiency means only 5 p.ct. of all the heat used at the electricity generating station. For things, of course, that it can do, there is an extensive field for electricity; and there is no necessity for gas engineers to shut our eyes to the fact. We should rather be prepared to co-operate with electricians in using electricity in its proper place; but that is not in heating. For a few purposes, it is very good indeed.

Prof. Cobb and Col. Smithells are on a very fruitful line; and I am sure that, when further experiments are made, they will find that, with even as low as 400 B.Th.U. gross you can get flame temperature enough for the mantle. I am rather pressing this point, because it should be your desire (and I think it is) to get a larger proportion of the heat of the coal carbonized into your pipes for distribution than at present. From the figures I have examined, the largest you get in at present does not exceed about 25 p.ct. There are a few verticals which go to 33 p.ct.; but you should certainly aim at 50 p.ct.—one-half of the total heat of the carbonized coal—being put into the gasholder. And if you do this you must work at a gross thermal value of about 420 B.Th.U. I believe that would be the most efficient gas for coal conservation capable of raising the incandescent mantle to a very high temperature. So far as gas-engines and fires are concerned, this gas is all right. The only doubt is the incandescent mantle. It wants experimenting upon.

Lord Moulton.

Lord MOULTON: I am entirely out of my place in this discussion. You are here to receive the reports of a carefully designed and carefully carried-out scheme of research on the special subjects to which you all of you devote your lives; and I am, even in a less degree than any of you, a mere spectator. The only persons who are qualified to speak on an occasion like this are those who, like the last speaker, can bring from their vast knowledge and experience some addition even to the gifts you have received from the Gas Investigation Committee; and I am sure I am speaking the feelings of you all when I say that we are deeply indebted for the clear *résumé* of the whole subject which we have just heard from Sir Dugald Clerk. The only thing that I can perhaps do usefully is to point out what service we should take for ourselves from the results of the paper that has been read. It seems to me that our first duty is to remember its conclusions, and master them, in order that they may be permanently part of the ideas present to our minds when we are thinking of the question of gas. The Committee have rightly divided the research into parts, taking one distinct part, and one only, for their consideration. They have given us reliable data for the behaviour of coal gas under consumption by being burned. They have taken all the ways in which coal gas is burned, and told you what are the rules which govern its efficiency for all the varied qualities. Now, that makes gas as a fuel something definite to you all—something of the value of which you can for yourselves form an idea—and the lessons which they have taught ought to be part of what I may call the commonplaces of the gas engineer's knowledge from this moment.

But the behaviour when burned is only one of the things you have got to think of. There are two other domains of research which are equally important, and which have probably not been touched. The first is the best method of producing gas; the next is the best method of selecting for combustion the components of gas. For it seems to me that we are more and more realizing that the strange mixture which you call coal gas is composed of very many distinct chemical compounds, of which more and more are proved to have an industrial value far too great to relegate them merely to the domain of fuel. We know some of them. I have known some of them during the past three or four years with an intimacy which even you have not got. But that is only the commencement of the analysis of gas, taking out of it the things which have a richer industrial value than that of fuel. I can see in the researches that are being carried out in this country and elsewhere indications that the list is going to be seriously added to; and, what is more, the number of uses that the well-known members can be put to are being added to every day. So that like researches on the mode of the production of gas, the mode of selecting what we shall use as fuel, and what we shall reserve for better industrial applications—themselves the broad domains of research—you must insist on being taken up by men of like ability, of like perseverance and like accuracy, with those who have given us this report to-day.

Now, I have told you that that which you should carry away and keep in your minds is what you have been told about the behaviour of gas as a fuel—or perhaps I had better put it more widely, and say for the purposes of combustion. One of the reasons for this, to my mind, is that where you find one gas is inferior to the other in its behaviour, though it has the same number of thermal units in it, you ought to realize that there is scope for invention, so as to use it better. Nature is absolutely rigorous on the subject of thermal units. You will not get out of a gas more thermal units than are in it; but if you find a useful result better obtained from the same number of units than it is when it is applied in a different way, that is an example of deficiency in invention. Let me take an instance. It is pointed out that, with regard to certain types of mantles, a rich gas will produce a better illumination than a poor gas, even though you spend a compensatingly large amount of the poor gas; and yet Sir Dugald Clerk has just been telling you that all you want is the same heat units, if you have the same flame temperature. The question of the flame temperature—*i.e.*, the flame temperature through the mantle—is clearly a thing which can be varied by devices which will make the flame not only fit the mantle at one pressure, but to a practical extent continue to fill it. That this has not been accomplished by these standard applications that have been tried, shows you a weakness in your accepted methods of using gas for this all-important purpose of the incandescent mantle. Wherever you find money wasted—by which I mean thermal units not producing their full effect—you ought to feel it a reproach to yourselves; for you as gas engineers should think as much of the efficiency of the methods of applying gas as of the efficiency of the methods of producing it. So that it seems to me that the positive results have put your minds at rest, showing that you have a very large choice of types of gas that do well for many purposes and equally well for the same number of thermal units. You have some exceptions from this which you ought not to think are unavoidable. You ought to feel that they are the consequence of your not in these respects being up to the mark. So you have consolation, and you have stimulus; and if you take away with you the knowledge, the consolation, and the stimulus, I am quite sure that this will be a memorable occasion to you all.

Sir George T. Beilby.

Sir GEORGE BEILBY: The time our President allowed to us to make our remarks in has already expired; but in any case Sir

Dugald Clerk and Lord Moulton have delivered such admirable and inspiring addresses that anything I could say would be an anti-climax. However, as one of your honorary members who came into possession of this report I believe on Monday, I should like to say that, after devoting many hours since then to a careful study of the report, I do most heartily wish to congratulate Col. Smithells, Prof. Cobb, Mr. Wood, and the Committee generally for their research, and upon the report they have brought before you to-day. Reference was made by the President to the meeting called by the Board of Trade rather more than a year ago, when our gas standards first began to be discussed; and he has emphasized what I personally felt on that occasion—that there was an extraordinary absence of any information on the side of the gas makers. However, great steps have been taken by the gas makers themselves in presenting this report. In an exceptionally modest disclaimer by the Professors in their opening remarks, they ask us not to regard this in any way as a record of their complete work. I think, therefore, it would be quite out of place, even had there been time, to criticize. I wish to heartily add that I do thoroughly appreciate the work done, and hope that this work will be continued with very great success.

Mr. Charles Wood.

The PRESIDENT: I am going to call upon Mr. Charles Wood, a member of the Committee.

Mr. CHARLES WOOD (Bradford): I really do not know what to say. What I, as a member of the Committee, have to say is here before you in the report. What I think we are here for is to hear criticisms, to pull it to pieces, or if anybody has anything to say about it. As far as I know, the Committee have spent a considerable amount of time in drawing up the report; and I agree with every word of what has already been said. I do not want to waste time by repeating things that are in the report itself.

The PRESIDENT: Mr. Wood has said the right word in the right place. I wanted that word said. It is very much my position with regard to the report; but I do hope that, whatever criticism is offered, those who may offer it will remember their position of responsibility at this most important juncture in the history of gas undertakings.

Mr. George Helps.

Mr. GEORGE HELPS (Nuneaton): I must crave your indulgence while I tell you a few of the things that I have been doing during the last fourteen years in connection with this matter. We all realize that nothing so important has ever been before the country and certainly not before our industry. I have been dealing with the Government on this subject in some direction or other for nearly the whole of my time since August, 1916. Much of my work has been public property for some time past. Some of you will remember that I was invited to discuss "Pleno" at the Gas Club six or eight months ago, and that for over two hours I endeavoured to answer every question that was put to me on the matter by over thirty engineers. Since then I have got many fields ahead. Mr. Smith himself honoured Nuneaton with a visit in February of this year; and among other things I showed him some of my drawings of flames of which I have had blocks made for over two years, but which under war conditions I have not been able to publish yet, though most of my work is recorded in type. I have given several demonstrations to various other gentlemen, who have come down during the last two or three years. Some fifty or sixty have seen my work and experiments, which I may therefore claim are fairly well known.

The main factors to my mind, based on fourteen years' experience, are these: (*a*) Flame structure and contact. Their importance has been borne out in the remarks of Sir Dugald Clerk and Lord Moulton this morning. (*b*) The next important matter is that one B.Th.U. is as good as another. If not, why not? What is the B.Th.U. It is the little chap that does the work, and he will do the work whatever company you put him in. I am absolutely satisfied that this is a correct statement of fact. (*c*) Then comes the question of appliances, again referred to by Lord Moulton and Sir Dugald Clerk. Here [indicating the appliances on the table] we have the appliances that have been used in the investigations covered by the report of the Committee; but these appliances do not give you the best results from the gas you are using, and they never will. Again, a most important matter in connection with the report is that gentlemen who have devoted probably no more months to this subject than I have years, use an arrangement of appliance that the consumer is not able to use; they are varying the distance of the vessel from the burner in order to get the best results. This the gas consumer cannot possibly do.

As Lord Moulton so aptly put it this morning, anything that helps to keep more B.Th.U. distributed as gas from the B.Th.U. available in the coal, is a matter for invention. There is no doubt about that. Lord Moulton also made a point of the selection of the components in the gas for special purposes, not merely as fuel. Again, said his Lordship, this is a matter for invention. Those of you who have seen my patent specifications will realize that I have covered this. I have looked on, and still look on, the questions of flame structure and flame contact as essentially my own. I am open to be corrected; but if there is any gentleman here who has ever seen any reference to the importance of flame structure and flame contact in the literature of this or any other country earlier than my own references, I hope that he will now declare it.

The authors have commented upon, and emphasized, the preliminary nature of their report; but yet they have stipulated a 500 B.Th.U. gas as the preferable quality to distribute with the present type of burners. They are absolutely wrong; and if wrong, what effect is the report going to have on our industry? Consider for a moment the cost of making a 500 B.Th.U. gas, against a 350 B.Th.U. gas. You will find there is no comparison. I warn you not to accept this report. It is untrue. I am convinced by my own practice, day in and day out, for over twelve months, that if we were to distribute a 350 B.Th.U. net gas to-morrow, the average consumers would get exactly the same duty, foot for foot, out of it as they get from the 500 or 550 B.Th.U. net gas they are at present receiving.

When I first made my chief discovery, it was in connection with flame structure and contact; and as soon as I realized what this meant—it seems ridiculous, I know, when I put it to you, but I will put it—that we could distribute the same heat energy at one-sixth of the cost (the basis of which statement I will refer to later), I did not know how to contain myself. I packed my bag and baggage and came to London, took a flat, and waited on Government officials daily, spending most of my time to begin with on the mat. I thought they would never let me go back to Nuneaton again when they heard what I had to tell them; but they were glad to get rid of me. If—there is no "if" about it, but I shall have to say "if" to you—if I am right upon this 350 B.Th.U. gas, and it will give consumers the same duty on the average as a 500 B.Th.U. or so gas, what does it mean in the saving of coal and in the cost of gas? I am dealing with the Government now; and I think I may tell you that I am likely to be given permission to experiment soon in several places with a 350 B.Th.U. gas. Obviously, 350 B.Th.U. gas can be produced much more cheaply than a 500 B.Th.U. gas; and, further, this quality allows more B.Th.U. to be obtained from a ton of coal. You know what 500 B.Th.U. gas costs to produce, either now, or pre-war.

I have already said that the burners used in the tests given in the report are not the best available; but it is quite possible to produce burners—and such burners have been produced—which permit gas of 350 B.Th.U. to give equivalent thermal efficiency as, if not higher than, can possibly be obtained with a higher-grade gas in existing burners, such as those used in the tests. At Nuneaton, I am able to show, side by side, to anybody who likes to come, upright mantles fed respectively with 350 and 500 B.Th.U. gas, without any perceptible difference in illumination; and this means complete incidence of flame temperature, film, or structure. I am prepared to give any sum you like to anybody who can tell the difference between the illumination from one flame and the other. I cannot. Here is a photograph that my friend, Mr. Duxbury, has taken of some upright and inverted mantles at Oldham. [Mr. Helps here handed the photo. to the President, and it was passed round.] This has no connection with me at all. He handed it to me last night. On one side you will find an upright and inverted burner supplied with 635 B.Th.U. gas, and on the other similar burners supplied with 475 B.Th.U. gas.

Now, in regard to gas-fires, I have fires at work giving just as good efficiency as—in fact, better—with 350 B.Th.U. gas than with 500 B.Th.U. Broadly, let me state one or two other things. I have 6000 consumers in Nuneaton, including 48 gas-engines; and since I have sent out a gas less rich in B.Th.U.—I do not mind this being published, for I am past thinking that I am doing my consumers out of anything, I know I am giving them advantages—I have had fewer complaints. Indeed, I may say I have not had any complaints at all; and the consumption has not gone up by a single foot. This may seem absurd; but, of course, it is very easily accounted for. If you send out a 500 B.Th.U. gas, each foot contains 500 of the little nigger chaps that do the work; and the consumer can only get work out of 350 of them, while the others run away to make horrid smells about the house. What is the result? You get exactly the same efficiency if you send out a gas with 350 B.Th.U., and they all do work. With 500 B.Th.U. gas they are too crowded to work. This is the simple explanation of the matter. Nobody can find any other.

Sir Dugald Clerk said this morning that we were only getting about 20 p.ct. of the B.Th.U. in the form of gas out of a ton of coal. Is not such a fact terrible to contemplate—20 p.ct.? We have got special machinery, and all sorts of things—I have said so often—to put our coal into retorts, special machinery to pull coke out, expensive labour to put 3 cwt. of coke from every ton of coal into the producer, expensive plant to convey, elevate, and screen the remaining coke, with special departments to sell the coke, and all the rest it. But what is all this for, when we can make gas containing 70 or 80 p.ct. of the B.Th.U. in the coal, gas that will do everything, and more than the gas we are sending out to-day, without all this expensive plant, machinery, and labour. I am doing it. Do not make any mistake about that, gentlemen. By this means, three times the B.Th.U. are produced in the gas for the same money—not 3 p.ct., three times; 200 p.ct. And if we are making it for 200 p.ct. less money, I take it we can sell it for 200 p.ct. less. The process does not affect seriously, if at all, the tar-oils per ton of coal. So far as I have gone, I am inclined to think it considerably increases them. Added to this, there is the fact that improved appliances are available that will in most uses give twice the duty of those as at present employed [pointing to the apparatus exhibited] here. What does this mean for our consumers? What does it mean for us? And what does it mean for our country? It means that we can take absolutely first place as fuel purveyors.

I am not going to complain about the little help I have received from anybody in this matter. I have taken up my line. It is a straight, undeviating one; and I am keeping on it right the way through. I am setting out, as some of you are aware, to demonstrate these things to the consumer; and it matters not to me—and I say this with every respect—whether you gentlemen take this matter up or not. Your consumers shall, and will. Consumers are not such fools as to sit down and pay £3 where £1 will do, if someone will only go and demonstrate to them that it can be done; and I am that someone. I will demonstrate that it can be done. One B.Th.U. is as good as another; and the only thing that we, as gas makers, have to consider is the question of distribution, and the adoption of improved appliances. Gas will be required in ever-increasing quantities; and the gas to make is that which contains the greatest number of B.Th.U. for 1d. at the consumers' appliances.

Dr. Davidson.

Dr. W. B. DAVIDSON (Huddersfield): The paper has been very plain sailing, and the data have been most useful. Personally, I have been greatly interested in reading it through; but I think some of the results are not the best results. In testing anything, you do not wish to give inferior results. Imagine the electrical people testing their lamps for efficiency and using inferior appliances. I think this is what must have been done. Of course, it is a preliminary report; but more particularly the efficiencies in incandescent lighting seem to me very low indeed. I think they should be 30 or 40 p.ct. higher. Some people claim nearly 100 p.ct. higher. Of course, claims are claims. I think that Mr. Helps would have done better if he had given us some figures, some statistics, of the best results. I am not sure that his air gas has been done justice to, because it is certainly not fair on the face of it to test all kinds of gas with one appliance. I wish, however, to refer particularly to incandescent lighting. Mr. Helps, of course, is right off the track when he says that one B.Th.U. is as good as another. Everybody should know that if you take electric energy, it is represented by a certain heat energy. When you use this for conversion into light with most of the best apparatus, you get something like 20 p.ct. efficiency. But with the best incandescent gas lighting, you get about 5 p.ct. Or take hydrogen and oxygen, and compare it with coal gas. You would not use air or hydrogen and air. The effect you get is totally different. You would never think of using your coal gas or air and hydrogen for a limelight—the effect is immensely different. One B.Th.U. is not as good as another in lighting. It all depends, or nearly all depends, on the flame temperature; and I am surprised that the investigators have made so little of flame temperature. I should have imagined they would have calculated the flame temperatures theoretically from the composition of the gases, and shown whether there is a great effect, as is universally recognized, of flame temperature. I hope that if these results are to be published, they will be published with a caution that they are only preliminary tests, and not the best tests. It would be a pity that it should be recognized that 15 candles (14·8 candles) is the highest efficiency one can get with coal gas—15 candles per cubic foot. And I should like to suggest that, instead of recording the results in so many B.Th.U. per candle-hour, which gives an inverse ratio, it should be done in candle-hours per cubic foot, based on (say) 500 B.Th.U. That is, you divide 500 by the 40, or other figure, as the B.Th.U. per candle-hour, giving you a figure which is rightly recognizable as so many candles per cubic foot on a certain thermal basis, just as you have candles per watt in electric lighting. Everybody must have appreciated the enormous amount of work entailed by all these experiments; and the industry must be greatly indebted to the Committee and investigators for what they have already done. But surely it is very necessary to be fair to fact, and give maximum and correct tests. The maximum attainable is the only correct test.

Mr. P. P. Channon.

Mr. P. P. CHANNON (Haywards Heath): Before this discussion goes any further, I should personally like to know if Mr. Helps, when he speaks of a 350 B.Th.U. gas, is speaking of 350 gross. The figures that were given by the Committee were gross figures. I know that Mr. Helps frequently speaks of the net value of the gas; and it would be a pity if there should be any confusion through failure to understand whether the two figures are both gross or whether one is gross and one net.

Mr. HELPS: I am sorry I did not mention it. I was referring to net. I always state net.

Mr. D. T. Livesey.

Mr. D. T. LIVESEY (East Grinstead): Would Mr. Helps tell us at what price he is sending out the gas that he has supplied up to the present.

Mr. HELPS: I do not think it has anything to do with it. I will only say this, that I have been sending out gas for twelve months; and I have not been delivering it at the price I could if I deliberately set out to do it.

Mr. W. M. Valon.

Mr. W. M. VALON (Stafford): I do not propose to say much on the paper, except one or two things in connection with what Mr. Helps has stated. The point of this research is a big one, inasmuch as it is to give a figure as to the quality of gas it is best to use. I would like to bear a certain amount of testimony on behalf of Mr. Helps, having made a very full investigation of some of his claims. I have paid many visits to Nuneaton, and have tested his gas as it is coming out; and I know that what he has told you to-day is quite true. It is the quality of gas that is being supplied. Also I have satisfied myself that the average consumer is not using more gas than he did some four years ago, when the quality was considerably higher. This certainly tends to me to prove that he must therefore be obtaining greater efficiency from the gas that he is using. I do not myself quite agree with Mr. Helps that one B.Th.U. is as good as another—that is to say, I do not agree with the bald statement, although it may be correct to say that the heat one gets out of the B.Th.U. is as good with a certain piece of apparatus. Coming to the apparatus, I should like to say that there is an apparatus on the market—I do not quite know whether it is available while the war is on, but it is able to be made—which will give an immense efficiency. I have made tests of this burner—it is a cooker burner. I tested, first of all, boiling a certain quantity of water with an ordinary cooker burner. It took 1100 units at 520 B.Th.U. gross gas. I then put through the cooker 400 B.Th.U. gas; and the B.Th.U. used were practically identical. I then tested with the special burner which I have mentioned; and the B.Th.U. used to boil the same quantity of water was just over 600—it made no difference whether you were using 500 or 400 B.Th.U. gas. It showed, of course, that the new burner, practically within a very heavy range, will give the same efficiency; whereas the existing burner was not giving the same efficiency in both cases.

The PRESIDENT: Will you tell us by what means you reduce the heating value of the gas used from 500 to 400?

Mr. VALON: The original gas was a straight coal gas—not exactly a straight gas, because there was a bit of a pull on it to get it through; but it was the sort of coal gas we are in the habit of sending out. The other one was the same coal gas mixed with a percentage of water gas, bringing it down to 400.

The PRESIDENT: That is quite a proper explanation of how you brought it down.

Mr. VALON: I do not think there is any more I can add of any value, excepting that, as we know that our friend Mr. Helps has for years been working on this question, I would like to ask if it would not be of value, and the proper thing, if he were to be invited to join the Committee you have formed to go into this very special matter.

Mr. H. Kendrick.

Mr. H. KENDRICK (Stretford): I notice from the tables in the report that various mixtures of gases have been tried, including one where the diluent was blue water gas. It appears that, so far, the tests shown here have rather dealt with two extremes—*i.e.*, a coal gas of comparatively high calorific value, and mixtures of very low calorific values. I think it would have been of much greater interest at the present time if we could have had some tests giving results of the mixtures which we are using at the present time, containing 20 or 30 p.ct. of blue water gas. It is quite possible we should then have got some information or proof of the idea which a good many of us are giving expression to now—that a coal gas diluted with (say) 25 or 30 p.ct. of blue water gas is, from our experience, as efficient, even with the incandescent burner, as the 525 B.Th.U. straight coal gas that is put forward in these tables. I think it is our experience generally that, both from photometric tests and observation, the incandescent burner to-day, with stripped gas diluted with blue water gas, is giving equal illumination to, or better than, the unstripped gas of a few years ago. Some information as to whether these tests will be continued on the lines of the present-day mixtures, I dare say, would be of interest to us all. With reference to Mr. Helps, I think his arguments would carry a great deal more weight with us generally if they had been backed-up with a few more figures. Simply to say that if we do not accept his position to-day he will go to our consumers, is too much bringing out the big stick. If he would table his facts and figures for us to consider, we should receive them with considerably less scepticism than he appears to think we have received his statements hitherto.

Mr. W. A. Tookey.

Mr. W. A. TOOKEY: This will give me the opportunity, if nothing else, of re-echoing the words that have fallen from Sir Dugald Clerk this morning, in that, so far as gas-engine compression is concerned, the experience that internal combustion engineers generally have had as regards calorific value per cubic foot is that there is very little in it. We can work, as we have worked, engines with natural gas approaching 1000 B.Th.U., as well as with a blast-furnace gas—which, as you know, contains about 100 B.Th.U. And, speaking generally, we obtain in gas-engines, small as well as large, the same efficiencies within very slight variation. That, so far as gas only is concerned. But the other point, which is also interesting to internal combustion engineers, and I hope to gas engineers also, is that this holds good equally when you are using petrol vapours and oil vapours—kerosene, for example, or the heavier fuel oils. The same efficiency—and when I use the word "efficiency," I mean the same number of B.Th.U. per H.P.-hour—is applicable exactly, varied by the compression pressure, which Sir Dugald Clerk mentioned this morning; it is the absolute basis upon which the engine efficiency can be varied. That being so, does it not look, from the gas-engine point of view at all events, that one B.Th.U. is as good as another? It has been questioned here this afternoon; but does it not add point to what Lord Moulton said this morning—that if one B.Th.U. does not give the duty that another has done at other

times, there must be something wrong somewhere. At any rate, he said that he would regard it as a matter which should have further consideration as being subject-matter for invention. I think that you will find—and I think a good many of you have found already during these last few years—that there has not been so very much difference between a 500 B.Th.U. gas and one which is much lower, varying in your respective districts. I was testing engines yesterday, and using gas which, by the calorimeter observation, was giving only 420 B.Th.U. on the net basis—something like 468 B.Th.U. on the gross. I have tested engines also with gases of 368 B.Th.U.; and it has worked perfectly well.

In March, 1917, I was invited to read a paper before the Society of Chemical Industry, on the composition of power gases; and I epitomized in the paper some of the results which I had obtained as the outcome of a series of tests which I had been making for the large London gas companies on gas-engines. I there laid it down that, taking all things, one with another, composition is the important thing, and not the number of cubic feet of gas used. There I think I cannot be in agreement with Dr. Davidson's remarks this afternoon. I think we ought to come to the rock basic elements of comparison. The cubic foot embodies some other qualification. The B.Th.U. we all know; and that is really the rock-bottom thing. If you have the number of B.Th.U. per cubic foot of piston displacement of the gas-engine cylinder, whatever the volume in the cylinder of the engine, and whatever the date of the engine (whether it was made 35 years ago or whether it is one of the most modern), the highest efficiency is always given with a mixture strength of about 45 B.Th.U. per cubic foot of piston displacement. Now, I put it to you that if you get—as I am quite confident you do get—engines working so similarly for so many years, you ought to obtain the same duties from gas in other directions from power for heat. We know we can get by the calorimeter all the heat value in the gas in a gas-furnace. It has been shown by Mr. Arthur Forshaw some time ago that a gas-furnace can be as efficiently used on a 500 B.Th.U. gas as on a blue water gas, or even less. Working on this matter, I was much interested in Mr. Helps's process, because it seemed to me to be the same idea with regard to illumination and for heating that I had as the result of my experience with power.

About six weeks ago I had the opportunity of going to Nuneaton, at the invitation of Mr. Helps, to see what he was doing; and I will not do anything more than attempt to tell you what I there saw. I saw, as he mentioned, this 500 B.Th.U upright incandescent mantle side by side with one working on 350 B.Th.U. gas. I can corroborate what he said—that there was no perceptible difference in the illumination of either of these two mantles. I also saw a gas-fire being worked there. I saw the burner which has been mentioned by Mr. Valon this afternoon; and I saw the figures which he then produced to me. They carried a certain amount of weight. But I am somewhat of a doubting Thomas, and I said: "Can you tell me whether you have had any complaints with regard to this?" And I was not satisfied until I saw his complaints book. I scrutinized the book very minutely, both before he began to issue the gas according to his statement and afterwards; and the only complaint that I saw was nothing at all about gas-engines. There were a few blocked-up burners, judging by the man's report that had been made; but there was nothing at all which one could see was the outcome of this lower-grade gas he was burning. More than that, this 350 B.Th.U. gas should be, to my mind, equivalent in illuminating value, when worked with the mantles, as the higher grade. As a sort of proof of this, I saw, also at Nuneaton, an incandescent mantle which was working with a gas which was very much below 350 B.Th.U.—below 200 B.Th.U. as a matter of fact. If this can be done (and it was done there), I should like to emphasize the opinion that, from my point of view, the case is not proved here that a 500 B.Th.U. gas is the best. I think you will find that, with the further investigations of the Committee that have been promised, some variation, and, I think, some very drastic qualification, will be forthcoming shortly, showing that no deliberate attempt was made, so far as I can detect in reading through the report, to make any adjustment to the injector nipple, for instance, of the particular burner used. Never mind whether it is old-fashioned or of the best type, without such adjustment it would be impossible to obtain the best results from the lower-grade gas. May I say this in conclusion, that, as internal combustion engineers have found it unwise to consider gas as the most important ingredient in the gas-engine, I would advise you to think that in all heating problems, such as illumination at the present day, and the gas-fire and the gas-furnace as well as the gas-fire—let me advise you to look upon it that air is the real heating medium, and gas is the carburetting medium with which to bring up the air and make it better capable of transmitting its heat to the objects desired.

Mr. CHANNON: Mr. Tookey has told us that the efficiency with a low-grade gas in a gas-engine is as great as with a high-grade gas. Will he assure us that the total power developed from a given engine per hour will be the same with a low-grade gas as with a high-grade gas? That is an important point to most of us.

The PRESIDENT: Mr. Tookey practically answered it by the reference he made to natural gas; but I would like him to give his reasons for it.

Mr. TOOKEY: The two things should not be confused. Efficiency is a thing by itself; power development is a thing by itself also. It is well known that you cannot absolutely get exactly the same power from a gas-engine—it wants adjustment. But you get very close to it. The main thing is that if you look upon it as I have suggested—you should look on the engine as a vehicle for using carburetted air—you will see that it depends on the air capacity rather than the gas capacity; and it is the air capacity which makes the slight variation in the power development per unit of cylinder size.

Mr. VALON: May I ask Mr. Tookey a further question? I think what Mr. Channon wanted to know was whether you get the same amount of power per cubic foot.

Mr. CHANNON: No; I was referring to the total output for a given engine.

Mr. S. Tagg.

Mr. S. TAGG (Preston): I think most members of the Institution will appreciate the opportunity of discussing a technical subject in the manner in which this has come before us to-day. It marks a distinct step forward in the method in which such an important subject should be placed before the members; and I think very great credit is due to the Committee for the manner in which this investigation has been carried on. It seems to me that it is merely the first stage of the investigation, and it has served to clear the air. But we have not sufficiently far-reaching conclusions. It seems to me that what we have done, or what the Committee have done, and what they have proved so far, is that, with gases of very considerable variation in calorific power and composition, their efficiency, either in the ring burner and necessarily in the oven burner and in the gas-fire and also in the low-pressure ordinary incandescent burner, is practically identical through the whole range of gases submitted to examination. It may not appear at first sight that this is a true statement with regard to the tests on the incandescent burner, because the tests are first of all calculated per candle power per cubic foot. If these, however, are looked on from the calorific basis, there is very little variation indeed between the best results obtained from each of the gases tested; the efficiency on the net calorific value is practically constant through the whole of the gases tried. The conclusion, therefore, arrived at is that the tests have shown that no particular gas, or no one gas, is better adapted, either for cooking or gas-fire burners or for the vertical incandescent burner, than another, with the result that it leaves entirely open the second portion of the inquiry which is, I understand, contemplated —*i.e.*, the cost of production. I think these results show that the whole of these gases are equally useful. The same efficiency is obtained—having regard, of course, to calorific value. If it is quite clear that you get the same efficiency from any one of the gases, then the important step to ascertain is which of these varying qualities it is most economical to produce; and the completion of the investigation is necessary before the Institution can arrive at a recommendation that gas of a particular quality is the one best suited to the needs of the industry. I would also say, incidentally, that the good work that was done with respect to the efficiency of the burner is perhaps as useful as that on the varying behaviour of the different qualities of gas, because, by merely altering the relation of the kettle to the burner and altering the degree of aeration of the gas, results are obtained which show a variation of some 33⅓ p.ct.—the best efficiency being something over 53, compared with the lowest of 39. This, I think, indicates the very great room for improvement that is possible in regard to the design of the cooking appliances. It is known to many that the progressive makers already have this matter under consideration, and have already done a great deal of experimental work, and are prepared to put before us, when peace time comes, appliances which reach a very much higher degree of efficiency than those to which we have been accustomed. Although this, in a sense, is not the object of the investigation, I think it is a very important and useful fact that has been brought out in connection with the work of the Committee.

Mr. Tim Duxbury.

Mr. TIM DUXBURY (Oldham): Like Mr. Valon, I have been investigating this question of high-grade and low-grade gas now for over six months; and we have been supplying in Oldham 400 B.Th.U. net for this period—not made on Mr. Helps's plant, but by means of vertical retorts. To my knowledge, we have not had, up to the end of the six months which finished at the close of September, any complaints as to the quality of the gas. As a matter of fact, we were supplying it three months before my Committee knew anything about it. I was afraid to tell them, because I knew if I told them some of them would begin to find fault. After they knew, one member of the Committee did find fault. He was the only man who has done so; and if he had not known anything about it, we could have gone on for the six months without any complaint at all. I have been in the habit of supplying gas of 550 B.Th.U. gross, about 500 B.Th.U. net; and we dropped down to 400 B.Th.U. net. We tried a mixture of vertical retort gas with blue water gas made on a carburetted water-gas plant; and our idea all through has been coal conservation. We were going to be without coal; and it was a matter of saving coal somehow, so we got the gas down to 350 B.Th.U. net. With this, we had complaints; but nine-tenths of the complaints were due to naphthalene, which had been forming during the summer. When the mills began to light-up, then we had many complaints from them. I do not think that if we had been free from naphthalene we should have had any more complaints than we have in the autumn of any year when the mills begin to light-up. With respect to the photograph produced, it was taken on the quality gas you note there—635 B.Th.U. gross, and 474 B.Th.U. gross—and I quite agree with Mr. Helps. As a matter of fact, it was my suggestion on visiting Nuneaton on one occasion that he

should fix the burners side by side; and I scarcely think there is anyone in this room who can tell the difference in the qualities of the gases.

Mr. S. TAGG (Preston): For the same consumption?

Mr. DUXBURY: The lower-grade gas does consume a greater quantity. The two burners are Bray burners, bought in the town, such as are used principally in Oldham. They were regulated in the same way; and, singular to say, though the air supply to both was exactly the same, and the pressure was exactly the same to both, one was consuming rather more gas than the other. I have not got the figures. I did not intend to speak, and did not bring the figures with me; but nobody can tell the difference between the two lights. In fact, when my Committee first saw the lights, all guessed the wrong one. They guessed the lower-grade gas for the higher-grade gas; and we have had mill managers also who have done the same thing. They have complained about the light in their mills; and yet they cannot tell the difference. We have had the President and the Secretary of the Cotton Spinners' Association; and they cannot tell the difference between the lights. I am thoroughly convinced now, after six months' working, that the 400 B.Th.U. gas, at any rate, is better than the 500 B.Th.U. Another thing we notice is that we get no stopped-up bye-passes, because the 400 B.Th.U. gas can draw in naturally its proper quantity of air for the proper consumption of gas.

Yesterday my Committee made a test for themselves with the burner that Mr. Valon has mentioned against a new ordinary hot-plate on a cooker. I will not give the name of either. It is one of the best hot-plates that we have; and the new burner gave the best results, after a large number of tests of all the makes we supply to consumers. The Committee made the experiments for themselves. The gas was of the same quality as that which we supply to the consumer; and the tests were both on the same sized kettle, which contained a quart of water. A thermometer was pushed through the lid into the water; and the tests were made in exactly the same way. The result was that the ordinary hot-plate burner took 3·75 c.ft. of gas to boil a quart of water, and the new burner took 1·32 c.ft. of gas. You can work that out for yourselves: 3·75 c.ft. against 1·32 c.ft. to boil a quart of water with the same quality gas, 480 B.Th.U. gross.

Mr. TAGG: From 60° to 212°?

Mr. DUXBURY: The temperature of the water was taken in both cases before commencing the test.

Mr. VALON (Stafford): How long did it take?

Mr. DUXBURY: I have not got the times. The figures I have been giving you are the only ones I jotted down. But it took a little longer with the lower-grade gas. We have also made many tests of the new burner against the old type; and we have got regularly from 60 to 65 p.ct. efficiency with the new burner, as against 22 or 23 p.ct. efficiency with the best hot-plate burner that we have on an ordinary cooker.

Just a word on 593 B.Th.U. gas gross and 441 B.Th.U. gross. We made a test the other day—I am referring to B.Th.U. used to boil a quart of water in the same way. The 593 B.Th.U. gas consumed 1726 B.Th.U. to boil a quart of water, and the 441 B.Th.U. gas took 1521 B.Th.U. This is not a solitary test. We have made dozens; and in every case, without any exception, the lower-grade gas will boil water with a smaller number of B.Th.U. than the higher-grade gas. This test was with the same burner in both cases—a new burner on an ordinary hot-plate. There is no doubt about it in my mind—I am thoroughly convinced—that a lower-grade gas than 500 B.Th.U. can be supplied. I am sorry that I have not had the pleasure of reading the report, which contains such valuable information; but I am convinced in my own mind that anywhere in the neighbourhood of 400 B.Th.U. is right. I am not going to say lower, because I cannot prove anything lower than that. From what I have proved for myself at Nuneaton—and we were in the very fortunate position on one occasion when I went there of having the expert chemist present from another large gas-works, and we tested the calorific value of the gas—I can confirm the figures that Mr. Helps has published from time to time. We got practically the same result on our visit to Nuneaton.

The PRESIDENT: I should like you to submit further evidence of the tests that you have mentioned. If you could give us both the time factor and a sketch of the arrangements showing the distance between the burner and the kettle which was being heated, it would be useful.

Mr. DUXBURY: I shall be very pleased to supply them.

Mr. S. B. Langlands.

Mr. S. B. LANGLANDS (Glasgow): My department consumes 400 million cubic feet of gas in normal times for the lighting of the city. I should like to say how much I personally appreciate this report, as one having charge of such a large consumption. Whether we are satisfied with 400 or 600 B.Th.U. gas, I think we are at least satisfied with this—that the efficiency does not lie entirely with the gas, but in the method of using it. Mr. Tookey has brought this out very clearly in his speech. Again, Dr. Davidson said "Don't throw overboard flame temperature;" and I am entirely at one with him in that. I remember years ago at this Institution a paper read by Mr. Forshaw, wherein he attempted to show the truth about flame temperature. When he could not get his flame to fit his mantle, he tried, by the extraordinary means of introducing a cone, to bring his flame up to the shape of the mantle instead of bringing the mantle down to the shape of the flame. This was fallacious in its method. We must watch, and be careful over, the report of this Committee. They will make mistakes—we all do when we try to arrive at the truth; but it can effect a very great deal. Where do we stand with regard to burners? Let us take the analogy of electricity. There you have a constancy at (say) 250 volts, and you have got your lamps built for 250 volts. We, on the other hand, may get a pressure of 3 in.—we may get 2½ in. or 2 in., and the burner may be adjusted for 2 in. A great deal depends on the adjustment of the burner; and we want the Committee to watch this in their investigations. We do not want it to be said that 15 candles is the power with the upright mantle—18 c.p. is the figure usually obtained; whereas with the inverted mantle properly adjusted one will always get a maintainable 25 c.p. per cubic foot. Many very perfect upright burners were made—notably a little French one which had a double ring at the air-inlet. But it required very perfect adjustment; and this has been the bother with all burners, and is the reason why many efficient burners were not a commercial success. In the Kern principle a bigger variation of pressure could be dealt with, as its mixing chamber was so efficient that the burner became self-adjusting. I am speaking in this way, because I am anxious that the Committee should look for perfection in the apparatus, as well as for perfection in the gas supply.

Mr. S. Lacey.

Mr. STEPHEN LACEY (Distributing Engineer to the Gas Light and Coke Company): I think Mr. Helps's axiom that one B.Th.U. is as good as another is the crux of the whole business; and I consider it is one that might very well be adopted by the Gas Investigation Committee. But it cannot be adopted by Mr. Helps, because he has been at great pains to prove that, at Nuneaton, where he supplies gas of 350 B.Th.U. his consumers use no more than when he supplies gas of 500 B.Th.U. How does he reconcile this with the idea that one B.Th.U. is as good as another? One is very much better than the other. The Committee have proved quite definitely, if you read the conclusions, that one is as good as another. As regards ring-burners and gas-fires, very nearly the only exception to it is the case of the incandescnt mantle; and it is quite conceivable that if you could vary the distance of your mantle as you vary the distance at the bottom of the kettle, that one is as good as another.

Mr. TAGG: It does.

Mr. LACEY: If Mr. Helps could prove this, he would have to cease.

Mr. HELPS: I will never cease.

Mr. LACEY: No; I do not think he will. Where does the consumer come in if one is as good as another? The gentleman who followed Mr. Helps explained that he had a gas-burner which was very much better than other burners—that whereas with the ordinary burner he used 1100 B.Th.U. to do something which he did not explain, when he used the other burner he only took 600 B.Th.U., and it did not matter whether the gas he used was 500 or 350 B.Th.U. Let us assume that the efficiency of the old burner was 30 or 40 p.ct., and of his second burner 80 p.ct. If with a 500 B.Th.U. gas this burner is going to give 80 p.ct. efficiency, with Mr. Helps's 350 B.Th.U. gas it would give 150 p.ct.; and you cannot have that in any case. It is true that Mr. Helps says that at Nuneaton they are not using any more gas with the 350 B.Th.U. gas than with the 500 B.Th.U. gas. It must depend on one thing, and one thing only—that these appliances are more efficient with lower-grade gas than with higher-grade gas. This can be reconciled conceivably with this report. It will be noticed, if you go through the curves, that in one particular curve, which is marked F, in the case of the kettle, if I read it rightly, where the distance of the bottom of the kettle from the top of the burner was 1 in., they say that the flame was smothered; and this increases the consumption. This explains Mr. Helps's case. It simply means that all his burners with the 500 B.Th.U. gas are being smothered, and that when he gives them a lower-grade gas they are burning freely. That is the explanation, I take it.

Mr. HELPS: A little more than that.

Mr. LACEY: I think that is all that I have to say. I might, however, say this, that in the last few months it is well known that gas has been gradually brought down, due to other causes than these; and those who have watched the consumption have had the opportunity of seeing that it has not correspondingly increased. Unfortunately, while the gas consumption has been going down, there have been other factors which have tended to reduce the consumption besides alterations in the character of the gas. They are so vast that you can hardly tell the difference between them. There is no doubt, however, that, within the last two or three months, the calorific value, the number of B.Th.U. supplied, has been reduced for one reason or another; and it is conceivable that part of the reduction has been due to the fact that a certain portion of the appliances in use are more efficient with low-grade gas than with high-grade gas. Of course, it is possible they get less light.

Mr. C. S. Shapley.

Mr. C. S. SHAPLEY (Leeds): With regard to Mr. Duxbury's remarks, we are all more or less sending out a rather inferior quality of gas, perhaps not due to coal conservation as much as balance-sheet. I should like to ask Mr. Duxbury to give us a little more information with regard to the utilization of this poorer quality gas, and whether he does not find that he has to put more pressure on his district to endeavour to get the consumers to use it, and whether his naphthalene complaints (which he mentions as being rather more excessive) are not due to the fact that he is

using a poorer quality gas. This has been my experience—that where the calorific value is reduced down as low as 415 B.Th.U. (that is the lowest I have sent out in the war period), I find that, when I reduce it systematically from 475 to 415 B.Th.U., my complaints double themselves. I thought it would interest the members to know that I took particular care in taking out my complaints; and I considered the result would be of interest to the meeting.

Mr. H. D. Madden.

Mr. H. D. MADDEN (Cardiff): With regard to this research work, a statement as to the specific gravity of the high-grade and the low-grade gases in each case might be recorded. We have the analyses and a lot of other data; but no gases are comparable unless we know what the specific gravity is.

Mr. LEATHER: It is given in the paper.

Mr. MADDEN: The idea is that this low-quality gas is going to stay, and we would like to have a real definition laid down by the Committee as to what really low-grade gas is.

Mr. Thos. Glover.

Mr. THOMAS GLOVER (Norwich): I am up-against gas of high calorific intensity; I am up-against gas of low illuminating intensity; and I am up against the statement that one B.Th.U. is as good as another. I think I can prove it. We have, in the case of Mond gas, a large installation in South Staffordshire supplying 140 B.Th.U. gas as preferable for certain industrial purposes; and one B.Th.U. is probably more valuable in this shape than it is in the case of a higher intensity for certain industrial purposes. If I want to burn metal on the top of a gas of very high calorific intensity, I use oxygen with it; and I can cut through thin steel plates very rapidly. I should use gas called acetylene. In that instance a B.Th.U. is of very much greater value in the case of high calorific value than it is in the case of low calorific value. These are the two extremes; and it is a contradiction of the general statement that one B.Th.U. is as good as another. If this discussion has proved anything, I think it has proved that the appliances we have been using for many years are quite unfitted for the high calorific gas we have been supplying, and that we have to make up our minds which is the gas we can not only make most economically, but which we can deliver to the consumers' burners and appliances most economically, and which will render the all-round service, not only of yielding its calorific value to the object to be heated, but will give a calorific intensity for radiation in gas-fires and incandescent mantles. I would suggest to Mr. Helps that we should be convinced much more readily by his eloquent speeches if he would consent to produce a revenue account of his undertaking for the last two or three years, or whatever period he likes, when he has been supplying the gas he is advocating. It would carry conviction at once if he could show that his consumers are perfectly satisfied with this gas which will give, in domestic and industrial use, the service that is demanded of it equally with gas of high calorific intensity, and if at the same time he is doing what he says he can do—distribute heat energy of 350 B.Th.U. at a sixth of the cost. We will want Mr. Helps to prove this.

Lieut.-Col. Smithells.

Lieut.-Col. SMITHELLS, called upon by the President, said: Do I understand that you wish me to reply to the discussion that has taken place? I was not sure whether we had arrived at the conclusion of the discussion or not.

The PRESIDENT: No other member rose.

Lieut.-Col. SMITHELLS: I will in a very few words express, as my colleagues would wish me, on behalf of the Committee, our very grateful sense of the appreciative way in which our results have been received. I am very sorry that, owing to still other gas engagements, I have been unable to be present at the whole of the discussion; and I am particularly sorry to have missed the speech of Mr. Helps. I always listen to Mr. Helps's speeches with pleasure. He does not always convince me; but he is nearly always refreshing. I have no doubt that any points he may have raised in cricicism will be dealt with in due course by Prof. Cobb or other members of the Committee. My only object is to express acknowledgments. The President, at an early period of the discussion, called upon three very distinguished men to speak. First, we had Sir Dugald Clerk—a man as you know of very first importance in connection with one particular use of coal gas, a man about whom also I might say a very great deal more. He delivered a speech which ranged over a large amount of ground. It was thoroughly appreciative, I think, of what we had done, with perhaps a small critical element in it as well, and that particularly interested me, because it referred to the question of the temperature of flame, which has been mentioned in one way or another by nearly every speaker who contributed to the discussion. I will not take time now to speak at any length of the question of the temperature of flame; but I would remind you that some years ago I had the honour to deliver an address to the Institution on this particular subject of flame temperature. I felt at the time that this address was not quite as successful as I should have liked, nor quite as successful as, indeed, I expected. I believe the reason was simply this—that the subject of the temperature of flame is an extraordinarily difficult and complicated one. It is a subject which I have studied for many years; it is one on which I have worked experimentally; and it is one which I have discussed with a great many men more eminent than myself and more competent, to get at the fundamental questions. And I am still left with very profound respect for the difficulties that are involved in a full consideration of the implications of flame temperature. I hope you will not think I am disrespectful if I utter a word of warning to those who are disposed to make quick and trite conclusions upon flame temperature and its effects. So far as our work has gone, it has been dealing with what is, and not what might be. We have been practical men—that is to say, we have taken gas as it can be made; and we have taken appliances as they are made. What one will do with, or what might be done under other conditions with, different appliances is a totally different question, which we have not touched. Then we had a speech from Lord Moulton, characteristic, forcible, illuminating, phrased perfectly, and right to the point, and containing appreciation of our work, which I am sure we all value very highly. The shortest of the three speeches we had was from Sir George Beilby; but I am bound to say it was the one which gave me the greatest pleasure. We desire in our Committee, and I am sure we desire in the Institution, that we shall work in the closest possible harmony with the Fuel Research Board. Nothing could be so valuable to the Committee and so gratifying as to have such words pronounced upon their first efforts in this direction as were pronounced by Sir George Beilby; and I should like to acknowledge this in the fullest sense. I should here like to add also this—that I think it is a matter of great good good fortune for us and for the nation that, in connection with this vitally important question of fuel research and fuel utilization, we have at the head of affairs a man of such scientific eminence and of such industrial experience as Sir George Beilby, and a man whose title to honour and confidence among his fellow creatures is so indubitable and so high. There I will stop, and say once more, on behalf of the Committee, that the great attention which the report is receiving will be a great encouragement to us.

Mr. E. W. Smith, D.Sc.

Mr. E. W. SMITH, D.Sc. (Birmingham): I have nothing to add to the report of the Committee. But as Mr. Helps has done me the signal honour of mentioning me alone of the many hundreds of people who have been to Nuneaton, seeing that I have visited his works, I think I ought to explain that he has given you an entirely wrong view of what was done there when I did visit the works. Mr. Helps was good enough to invite four of us to see his process. When we went over there I told him that I, for one, was not prepared to sign any agreement binding me for the future till I got further information. I do not know whether because of that or not, but he was not prepared to tell me anything more than the fact that he was mixing 30 p.ct. of air, or 33 p.ct. with 66 p.ct. of coal gas, to show us the instrument to check it, to show us the burner used on the two gases without meters, and the incandescent burners that were used. And there was an end of it. We were more particularly interested in that particular side of the thing—the mixture of air; the first principles we were not entirely interested in. We were more particularly interested in the subject in which we have been experimenting for some years—that of mixtures of high-grade coal gas with blue water gas; and we thought that, in the initial stages, he had probably got some system by which combination of the gases could be brought about in a very much cheaper way than it was being brought about by generally accepted methods up to a year or two ago. Not a single fact, not a single piece of data, nor a single suggestion nor a hint was brought forward by Mr. Helps to indicate what his proposals were in that connection. There we left him; and there it is left. If there is anything in the new method of producing the gas from the coke and the coal by more efficient conditions, I can assure you that I am one of the most eager supporters of those who agree that the most efficient means of making gas is by producing coal gas of high calorific value mixed with blue water gas with low inerts, and distributed under such conditions; and the curves have to be watched that the cost of distribution does not bear too high a figure compared with the number of B.Th.U. produced per cubic foot. If we are to take all Mr. Helps says as being literally correct, then I challenge him that he can produce three times the number of B.Th.U. per ton of coal with 80 p.ct. efficiency on the calorific value basis of the coal. It cannot be done. Every speaker—and he has bandied a good many names across the room to-day—who has apparently supported him, and he has claimed their support, has disproved his agreement. They have shown their disagreement with him that one cubic foot of low-grade gas is as good as one cubic foot of high-grade gas. That is his chief and preliminary claim; and it is obviously incorrect.

Mr. A. W. SUMNER (Grays): No; he did not say that. He said one British thermal unit.

Mr. SMITH: No.

Mr. SUMNER: What is your view, Mr. President?

The PRESIDENT: One British thermal unit, I think.

Mr. SMITH: I do not think he said that.

Mr. SUMNER: This is hitting below the belt. Mr. Helps is not here.

The PRESIDENT: There is nothing in that. I did not call on the speaker; and he is within his rights. He is very patiently asking whether, in saying what he has, he is correct or not; and he is quite prepared to accept a correction.

Mr. SMITH: I should like to point out that, when our President was good enough to call on me to speak, Mr. Helps was occupying the end of the seat, and he went out. I had to decide in my own mind whether it was worth while speaking or not; but I think, for the good of the industry, it is necessary for everyone to air his views if they are to the point. I should like to point out

that if Mr. Helps did not make the statement that a cubic foot of low-grade gas is as good as a cubic foot of high-grade gas, what was his object in challenging the Committee's report, which practically states from end to end that one B.Th.U. for general purposes is as good as another. This is generally the tendency of the report of the Committee—to indicate that, from the point of view of gas in use, one B.Th.U. is pretty well as good as another. There are particular uses where it is not so. If Mr. Helps was not challenging that, what was the point of his speech? There are other points I object to in the way this matter is being brought out. For instance, the photographs which he showed this afternoon with two distinct exposures showing equal illumination.

Mr. LANGLANDS: Are they two distinct photographs, or are they on the same plate?

Mr. SMITH: If they are taken on the same plate, there is no significance, because the light is common to both.

Mr. DUXBURY: They are both taken together.

Mr. LANGLANDS: Was there a screen above the plate?

Mr. DUXBURY: There was a screen between the lights.

Mr. SMITH: Whatever the method, his photographic representation of the results is fallacious.

The PRESIDENT: I think these photographs will be taken for what they are worth.

Mr. SMITH: I am complaining, as a duty, of the method of doing the industry good that is being adopted by Mr. Helps. I agree with Mr. Helps in most of his principles.

Mr. DUXBURY: I would like to say that Mr. Helps had nothing whatever to do with the photographs. He never saw them until either to-day or last night.

The PRESIDENT: That is quite right.

Mr. SMITH: I am asking why do you use them; I am not asking why did you take them.

The PRESIDENT: I think you may leave it there.

Mr. SMITH: Another point. Mr. Helps knows, if he has read the report, that the efficiency shown by water boiling tests is rather over 52 p.ct. If he can get double duty by supplying lower-grade gas, he is going to do very well by getting over 100 p.ct. efficiency. In water boiling, the efficiency is shown to be well above 100. I am afraid I am trespassing on Prof. Cobb's time; but as regards flame contact, when I had the honour of being presented with the silver medal of the Institution for a paper on high-pressure gas, the only person who protested against it was Mr. Helps. It was on the basis that it was impossible to obtain the higher efficiency in water-boiling tests obtained by us in Birmingham by the intimate mixture of air and gas with high-pressure gas. It was said that it was impossible to get this high efficiency. This efficiency was explained at the time—it was due to flame contact and flame temperature and intimate contact. This you will remember occurred. Then it should not be forgotten that Mr. Forshaw, in his research at Leeds, by inference and by statement, laid stress on the importance of flame structure. There is no question of that. Lieut.-Col. Smithells had dealt with flame *ad infinitum*; and claims of this kind should not be taken too seriously. I cannot say anything more useful. Mr. Wood and Prof. Cobb can reply to the rest. But in reply to Dr. Davidson, it should be pointed out that, whereas the electrical people certainly quote figures for their best lamps, we are not testing apparatus—we are testing gases under standard conditions with existing appliances. No attempt has been made to find an apparatus which is exceptional in use, but one which is a practical thing in general use. The gases were the factors that had been tested, not the apparatus. This cannot be laid too much stress upon—that it is the gases that have been tested and not the apparatus.

The PRESIDENT: I think it is right to emphasize once more that the report deals only with preliminary work. It would not have been in order to have taken the apparatus to which Mr. Valon referred, because it is not typical.

Mr. LANGLANDS: On a point of order, Mr. President, these figures will be seized upon with avidity. The best available apparatus should have been taken; otherwise you are not doing yourselves justice.

The PRESIDENT: I should like you to accept my assurance that the work is not finished.

Mr. LANGLANDS: I know; but this is going to be published broadcast.

The PRESIDENT: You have made the point quite clear, you need not be anxious; and it will not be forgotten.

Mr. J. H. Brearley.

Mr. J. H. BREARLEY (Longwood): I am glad Mr. Smith has emphasized the fact that we were testing gases and not appliances. That was running through my mind; and it must be emphasized that the Committee were not testing apparatus. I believe the reference to the Committee is to find out which is the quality of gas best adapted to public supply, or something to that effect. We have to make a start somewhere; and the Committee have proved, I think, to a great extent that one B.Th.U. is pretty well as good as another in a lighting burner and in a gas-fire. We are not doing anything with regard to the lighting appliances; and I have got up really to impress upon the meeting not to take the figure of 525 B.Th.U. as being a likely one for lighting until we have carried this investigation further. This is merely a deduction from one burner which we used to compare the different gases; but I am hoping and expecting that, when we carry the investigation further, we shall probably have a different figure from that. Beyond this, I do not want to commit myself. We have not tested the inverted burner; and this may have been found to be totally different from the upright burner. If anything has confirmed the value and importance of this research, it is the discussion this afternoon. It is a firm proof that this is the proper way to begin to investigate these things; and I hope the members here will realize that, although we have compared these appliances and have only got (say) 15 candles in an upright burner, surely nobody is going to take this without the context of the research, and what the applications of the research are. We have not been testing incandescent burners. There is one point I should emphasize—that, even as far as we have gone, there is a good deal to inspire makers of these appliances. It has been shown, both by the results with the upright burners and by the discussion this afternoon, that there is a wide range of efficiency with the same quality of gas according to the appliance; and I would urge makers who may read this discussion to apply themselves closely to this question themselves. I believe they have the technical staffs and men competent to take records and tests and research, and to concentrate upon this and let us have the best appliances possible.

The President in Conclusion.

The PRESIDENT: Before you go, I desire, in regard to what Mr. Helps said, to inform him, on behalf of the Institution, that he must not think that silence on our part with regard to the very positive assertions that he made this afternoon can be taken as any measure of consent. I would have liked to have told him so in the presence of the meeting; but I make the statement now, so that it shall go along with the discussion, in order that Mr. Helps will see that we have not accepted his statements by not immediately contradicting them.

Prof. COBB: In reference to the question that has been raised by the gentleman just leaving the room (Mr. Sumner), and which caused some little side discussion between him and Mr. Smith, I think many of us have been struck by an incongruity, while Mr. Helps was speaking, inasmuch as he gave his opening discourse on one B.Th.U. being as good as another, and then spent considerable time in proving that a cubic foot of gas of 300 B.Th.U. was as good as a cubic foot of gas of 500 B.Th.U.

Mr. SUMNER: Mr. Helps explained that when he said that his consumers got equal duty with 350 B.Th.U. gas, for the reason that they actually used the whole of the B.Th.U. in that gas, whereas with the 520 B.Th.U. gas the consumers wasted the difference. This was his explanation; and I think that it was accepted at the time.

Prof. COBB: It is an example of the danger attaching to a glib statement which should be put scientifically to let us have it properly understood. What Prof. Smithells has pointed out in his reply to the discussion leaves me very little need to say anything, because I wish to leave the details to Mr. Wood. Flame temperature is a term which has been banded about pretty freely; and probably Sir Dugald Clerk, Prof. Smithells, Dr. Davidson, and other speakers, are agreed really upon the essentials of the matter. The fetish to which I particularly referred in introducing the report was flame temperature spoken of as if it were a possible working standard of quality for gas; and what I pointed out was that there were difficulties in the way of making it a standard which were insuperable. I should like now to give Mr. Wood an opportunity to reply in more detail to the criticisms which have been made.

The PRESIDENT: I am going to give Mr. Wood every facility for replying. I have asked him to submit his reply to the discussion (in as much detail as he desires) in writing; and he has promised to do so.

Gas Supply in Turin—Experiments in Wood Carbonization.

The annual report of the Turin Gas Consumers' Company (Società Anonima dei Consumatori di Gas-Luce) contains an interesting reference to the construction of gas-furnaces, designed for the carbonization of Italian coal or wood, and also of producers for using such material for heating the retorts. It is proposed to mix the gas with that from the carbonization of the ordinary English coal normally used. The work is nearing completion; and the furnaces will shortly be under fire. The supply of coal arriving at the works is but little more than the daily consumption; and the experiment about to be made is an effort to meet the extraordinary difficulties due to the war. Sympathetic reference is made to the death last May of Cav. Gioachino Fornas, who was for over thirty-four years the respected President of the Company. The entire suspension of the public lighting has still further reduced the consumption of gas, which amounts now to over 13 million cubic metres, as compared with over 21 millions in the year 1914. The hope is expressed, however, that return to normal conditions will see a recovery in the gas produced and sold; and with this end in view, efforts are being made to maintain the plant, as far as labour and materials allow, in a good state of efficiency. We trust that our Italian gas colleagues will soon emerge from their present difficulties, and in due course receive the reward of their valiant efforts.

In a large shipbuilding works in Alameda, U.S.A., gas is to be used exclusively for rivet-heating, plate-bending, &c. With a continuous and uniform gas-forge, the heater man can give his undivided attention to regulating it, so that there will be no burned or over-heated rivets.

PERSONAL.

Mr. R. W. Cowie, of Dalkeith, has been appointed Gas Manager at Port Glasgow, in succession to Mr. George P. Mitchell, at a salary of £350 a year.

Mr. James A. Waterer, one of the Employee Directors on the Board of the South Metropolitan Gas Company (representing the salaried staff), having retired by rotation in accordance with the scheme, has been re-elected without opposition.

The officials of the Teignmouth Urban District Council have presented Mr. J. A. Gray, the Gas Engineer, on his leaving the town, with a suitably inscribed silver tray. The presentation was made by Mr. A. Percival Dell, the Clerk, who said the Council were losing an able official, who had always worked well with his colleagues.

Mr. J. E. Holliday, the Assistant to the Engineer and Manager of the Yeadon and Guiseley Gas Company, near Leeds, has been appointed Second Assistant to Mr. J. W. M'Lusky, the Engineer and General Manager of the Blackburn Corporation Gas-Works. Mr. Holliday has been a successful technical student, and holds honours certificates in gas engineering and supply, chemistry, applied mechanics and drawing (fourth year), with "distinction."

OBITUARY.

Sir John Forrest, who died on the 3rd ult., at Sierra Leone, was for some years Chairman of the South Brisbane (Queensland) Gas Company.

Alderman Robert Thornton, of Brighouse, who died on Saturday of last week, at the age of 82 years, was a woollen manufacturer by trade, but had long ago retired and devoted himself to public life. He was Chairman of the former Rastrick Gas Company (now absorbed in the Brighouse Corporation undertaking), Vice-Chairman of the present Elland Gas Company, and Chairman of the Longwood Gas Company. After election to the Brighouse Town Council, in 1902, he quickly made his mark as a member of the Gas Committee. He was Mayor of Brighouse for seven successive years.

ELECTRICITY SUPPLY MEMORANDA.

The operations of the Coal Controller's Department may not be to the satisfaction of all responsible electrical engineers and managers; but in part the operations promise to have an educative value that will be of advantage in future if engineers will only consent to profit by them. To do things the easiest possible way is a human tendency; but if another way which may not be quite so easy will produce economy in any shape or of any value, it is the duty of the engineer to take that way. It is especially so under the existing coal shortage. The electrical engineer is learning more about the value of coke and coke breeze than he ever knew before, and as to the best methods of use in order to get from the one or the other (together with his boilers) the best possible evaporative duty. He is also learning more about his own shortcomings in respect of his boiler-house efficiencies than he ever troubled to ascertain before. There has been a great deal of plain speaking, ever since the Coal Controller made the disclosure as to the consumption of coal by electricity station plants varying from between 2 and 3 lbs. up to 17 to 18 lbs. per unit of electrical energy generated. These matters are being dealt with by the missionaries of the Coal Controller on every occasion that opportunity presents itself. They are found in the address which Mr. David Wilson delivered to the Association of Engineers-in-Charge; and in that which Mr. D. P. Kirkham lately delivered to the British Association of Textile Manufacturers (Manchester Branch). Mr. Wilson emphasized the fact that the coal consumption in electricity stations varies from 2 to 18 lbs. per unit, and the thermal efficiency from 3 to 16 p.ct. Poor load factor, obsolete plant, and low-grade fuel are rejected by him as a complete explanation of these immense differences. They do explain them to a large extent; but there is an unaccounted-for loss which should not exist. Mr. Wilson quotes a case in the North of England where the thermal efficiency is over 16 p.ct. using coal of only 10,000 B.Th.U. per lb. It may be a lot more troublesome to use low-grade fuel; but high efficiencies are realizable. And these are days that call for economy. When peace times return, too, it is a question whether the extra supervision that the use of low-grade fuel demands would not be well compensated by the economy in cost. Electrical engineers have to learn that it is no use placing a man in charge of boiler plant who is simply a shovel man. Brain as well as muscle is required. A good man should be installed as much as good plant. Mr. E. W. L. Nicol, Mr. Kirkham, and Mr. Wilson severally and collectively bear testimony to what can be done with low-grade fuel given suitable plant and men.

Low-Grade Boiler Fuels.

In every direction we see electrical engineers are urged to use coke or coke breeze mixed with slack. This is being done at many stations; and the economy is of a material order. Mr. Nicol has often shown that coke has a net evaporative value of about 9·8 lbs., and coke breeze of 6 lbs.—the same as slack. But in dealing with Mr. de Segundo's recent article [*ante*, p. 131], Mr. Nicol, in his modesty, it seems to us, fell short of the total evaporative duty of 11 cwt. of coke by nearly 1000 lbs. However, we have here one of those methods of effecting economy which is not the easiest way; and so some engineers would rather sacrifice the economy than slightly enlarge their responsibility. With them national advantage goes for naught. As a matter of fact, the utilization of coke and coke breeze is just as good as, if not better than, electricity stations becoming their own coal carbonizers; for in this way they are allowing those whose business it is to carbonize coal to provide products which are valuable as carbonaceous solid fuel, high explosives materials, fuel oil, artificial manure, and many other things. The question of mixing coke breeze and slack need not cause any difficulty. In some cases the two fuels are merely mixed in the bunkers; Mr. Nicol can tell of another highly successful system of utilizing coke breeze and slack in layers on chain-grate mechanical stokers. The Technical Advisers Department of the Coal Mines Department have particulars of all the methods that have been devised for utilizing together the two low-grade fuels. Coke breeze, of course, usually requires a forced draught; but it can be burned on ordinary hand-fired grates—the proportion varying with the draught, the boiler load, and the class of coal in use. About 12 lbs. per square foot of grate area can be used with ordinary hand-fired natural draught plants, against (say) similar boiler plants usually burning 20 to 25 lbs. per square foot. We are confident the work that is being done now in the utilization, for steam-raising for electricity generation, of fuels produced by gas-works will be of permanent advantage to the two industries.

Coke, Coke Breeze, and Slack.

An interesting report comes from America on the subject of electric-cookers. The Southern California Edison Company have more electric-cookers connected to their mains than any other supply undertaking in the States. During the period of two-and-a-half years ending May 1 last, they sold no fewer than 3000 ranges. The Company are holding their hand now, and intend to let the connections foster the desire for more electric-cookers, so that on the return of peace business may again be taken up with energy. It seems to be rather a pity to allow a break in the business unless absolutely compelled. However the Company know their own business better than anyone else. The most interesting point of the report is found in the replies to a number of questions the Company sent out to the users of the electric-cookers; and probably in the crop of difficulties produced by the cookers already installed there is an explanation of the Company's preference for not increasing their obligations in this direction during war time. But before dealing with the crop of difficulties, it is rather interesting to note the points about electric-cookers that commend themselves to the users. These are put first in the report; and they have a strong family likeness to the features which commend gas-cookers to users—only in the case of these, there are no parts which get out of order, other than through long age. The points that commend themselves are: Cleanliness, convenience, ease of operation, absence of heat in summer, safety, saving of food and retention of flavour, automatic features, absence of smoke, low cost of operation, hygienic merits, and accuracy. There are certain of these commendatory points that cause one to smile. For instance, "absence of heat in summer." Does this mean that there is heat in winter, but absence of it in summer? Seeing that cooking cannot be done without heat, the expression is rather a curious one. Then as to "safety," there are cooks who have painful recollections that cause them to doubt the truth of the assertion. "Saving of food, and retention of flavour." Any cook worthy of the name knows how to secure these things whatever the heat agent. "Absence of smoke" is padding. "Low cost of operation" cannot refer to all the work comprised in cooking, in view of the low efficiency in boiling operations.

Commendatory Points for Electric-Cookers.

But all these points in commendation are overwhelmed by the "weak points and causes of trouble." The most frequent difficulty is stated to be the burning-out of elements. Gas-burners in gas-ovens do not transgress in this way. Blowing of fuses is also responsible for trouble. Gas-ovens have no fuses to blow. Slow heating by electric boiling-rings is another cause of complaint. It is not a trouble that can be alleged against gas boiling-rings. The fracture of the firebrick supports for elements is a trouble which has not any likeness in gas-stoves. Other difficulties are the breaking of switches, the discolouration of oven-rings, time taken to effect displacements, untrustworthy thermostats, and leakage through the oven door. It will be remarked that these troubles are mostly peculiar to electric-ovens and not to gas-ovens; and the unreliability they represent is a difficulty which is as weighty as initial cost, running expense, and dilatory operation. A significant statement is that only about 5 p.ct. of the ranges supplied by the Company are installed in apartment houses or

Weak Points.

flats; and these cause the Company about four times as much trouble as those used in private houses—the assumed cause being that short-period tenants do not take sufficient interest in the cooker, and do not study the subject of electric cooking sufficiently to obtain the best results. But earlier in the report we read of "ease of operation" and "automatic features," so what is there to study in order to obtain the best results? Commenting upon the report, the contributor of "Cooking and Heating Notes" in the "Electrical Times" remarks: "Although in America at least the cost may be greater than with gas, the compensating advantages of electrical operation are being realized; and there are strong indications that the public will show the same preference for electric cooking that it has done already in the case of electric lighting, in spite of the possibility of increased operating costs." What a wealth of hope is in these words; but how shallow is the foundation.

Preventing Cooker Heat Losses.

It might have been imagined from the extraordinary praise with which electric-ovens have been coated that they had already been brought to a pitch of perfection beyond which it was impossible to go. But we gather from "Cooking and Heating Notes" in the contemporary just referred to that convection and radiation losses are unduly heavy in some types of electric-ovens. Also, "that considerably higher efficiencies than those commonly obtained in practice are possible with electric-cookers few will dispute, and, with the increased cost of energy, any conservation of heat that can be secured by better design is worthy of careful attention." Of course, anyone who knows anything of the subject realizes that, with the cost of generating heat electrically, it is absolutely necessary to adopt every possible refinement to preserve the heat, and to bring it into profitable account. The admissions are found in an article describing the "Purser" cooker, in which apparently an effort has been made to overcome the defects of kindred electrical productions. One of the new cookers is for domestic service, with internal oven dimensions of 18 in. by 15 in. by 21 in., or a cubical capacity of 5670 in.—the full loading being 2·9 KW. The interest, however, attaches to what the makers have done to reduce both convection and radiation losses. Metallic connections between the cooking space and the oven frame have been eliminated—the oven lining being isolated metallically, and supported by heat-insulating material. The space between the inner and outer surfaces is packed with a special form of lagging, while an air space separates the lagging from the oven lining; the latter also having polished surfaces, which still further reduce loss by radiation. How long the surfaces will continue bright is not known. The use of metallic connections between the inside heated surface of the oven and the outer frame are alleged to be responsible for much loss of heat through conduction to the casing, and thereby convection to the air. It is stated that tests with the "Purser" oven show that, throughout the cooking operation, the frame remains cool. Further evidence of the need for every precaution to conserve heat is shown by the infinite care that is taken to prevent loss through the oven door. It is built of three parts—the outer frame, a centre packed section, and an inner lining. These are separated one from the other by spiral springs, so that practically there is no contact between them. The edges of the door are also bevelled, so that a tight joint is made with the oven itself when the door is closed; and two spring catches—one towards the top, and the other near the bottom—tend to minimize risk of heat leakage through possible warping of the door after prolonged use. But with all this heat care, it takes 35 minutes for the oven to reach a temperature of 394°, with an energy consumption at the rate per hour of 2·9 KW. In other words, 1680 watts, or 5746 B.Th.U. are expended in reaching 394°. The fact that there is still loss of heat, notwithstanding all the very wonderful precautions taken to avoid it, is proved by the fact that it is necessary to continue the use of current to maintain the cooking temperature. Anyway the lengths to which the makers of ovens find it essential to go, to reduce the cost of energy by saving heat, tell an eloquent tale.

Private Plants and Waste Heat.

The "Electrical Review" describes the enterprise in fuel conservation of an electrical engineer—Mr. F. A. Wilkinson, of Hatfield, Herts—who does not tap a town supply for his electricity, but has his own private generating plant. He uses an internal combustion engine; and the exhaust (fitted with a silencing device) is connected up to lengths of pipes in the rooms of the house in such a way that the temperature can be regulated—a branch pipe being also taken to the kitchen to heat a jacketed cooking range, which in addition is fitted with electric elements. Piping from the engine water jacket is run to hot-water radiators, and terminates in the bath-room. Any surplus electrical energy generated on very cold days is absorbed by electric radiators. Six rooms are heated by the exhaust gases and jacket water; and it is said a bath of hot water can be obtained in eight minutes from the engine, and when desired be bye-passed through the radiators. Ordinary gas-barrel is used for the piping. A thermostat is now being installed, so that the engine will be started and stopped automatically. Seeing that some 70 p.ct. of the total heat of combustion is carried off by the exhaust gases and water jacket, the utilization is ingenious. But what about all the talk there has been of the superior economy of super-power plants when so much can be done with a private electricity generating plant?

MODERNIZATION OF PLANT.

By H. C. WIDLAKE, M.J.Inst.E., of the Plymouth and Stonehouse Gaslight and Coke Company.

(*Concluded from p.* 234.)

THE manner in which the connections last referred to may be made is indicated in fig. 8 (p. 302), which shows both the existing connections between the controller and the single-motor on the machine as they now exist, and also the new diagram to which the machine must be wired in order to operate both the stoking and travelling motor from the main controller, *viâ* the directional or change-over switch. A competent electrician will be able to effect the necessary alterations and additions to the wiring in such a manner, and in such stages, as will permit of the work being carried out in the periods during which the machine is idle.

This work having been completed, it will be found that when the change-over switch is in the "stoking" position, the motor on the inner frame will respond to the movement of the controller handle; while, if it is desired to work the travelling motor, the change-over switch must be set in the "travelling" position.

It should be pointed out at this stage that, though it is desirable that the travelling motor should be given a spin, in order to prove the accuracy of the new wiring, the controller handle should not be moved beyond the first notch, as the unloaded travelling motor will have a tendency to race, and may easily attain a destructive speed.

The connections having been proved correct, the handle of the change-over switch should be set in the "stoking" position, and the stoking work carried on with the machine as though the change-over switch did not exist.

STAGE NO. 3.

For the completion of this (the final) stage, the machine must be taken out of commission, and placed in such a position relative to the settings as not to cause any interference with the work of hand-charging the retorts.

The first step will be to remove the bearing bracket D, fig. 1 [*ante*, p. 172] at the top end of the vertical shaft, and draw the bottom end of the shaft out of the bevel wheel underneath the sill-plate, into which it is keyed—thus removing the shaft altogether. If the bevel wheel E, fig. 1, taken from the bottom end of the vertical shaft is in good condition, it may be used again on the short vertical shaft projecting from the new travel motion gear-box; but there is always risk of the wheel being injured during the operation of removing it from the old vertical shaft. It will, therefore, be safer to have a new bevel wheel ready fitted to the short vertical shaft on the new gear-box, and temporarily removed from it. This precaution will also save time; and, if the old wheel is in good condition, it can be returned to stock as a spare.

The vertical shaft having been taken away from the machine, the old travelling gear-box on the inner frame of the machine A, fig. 1, should be unbolted and taken away; and as much of the old travelling clutch-gear on the inner frame removed as the general lay-out will permit.

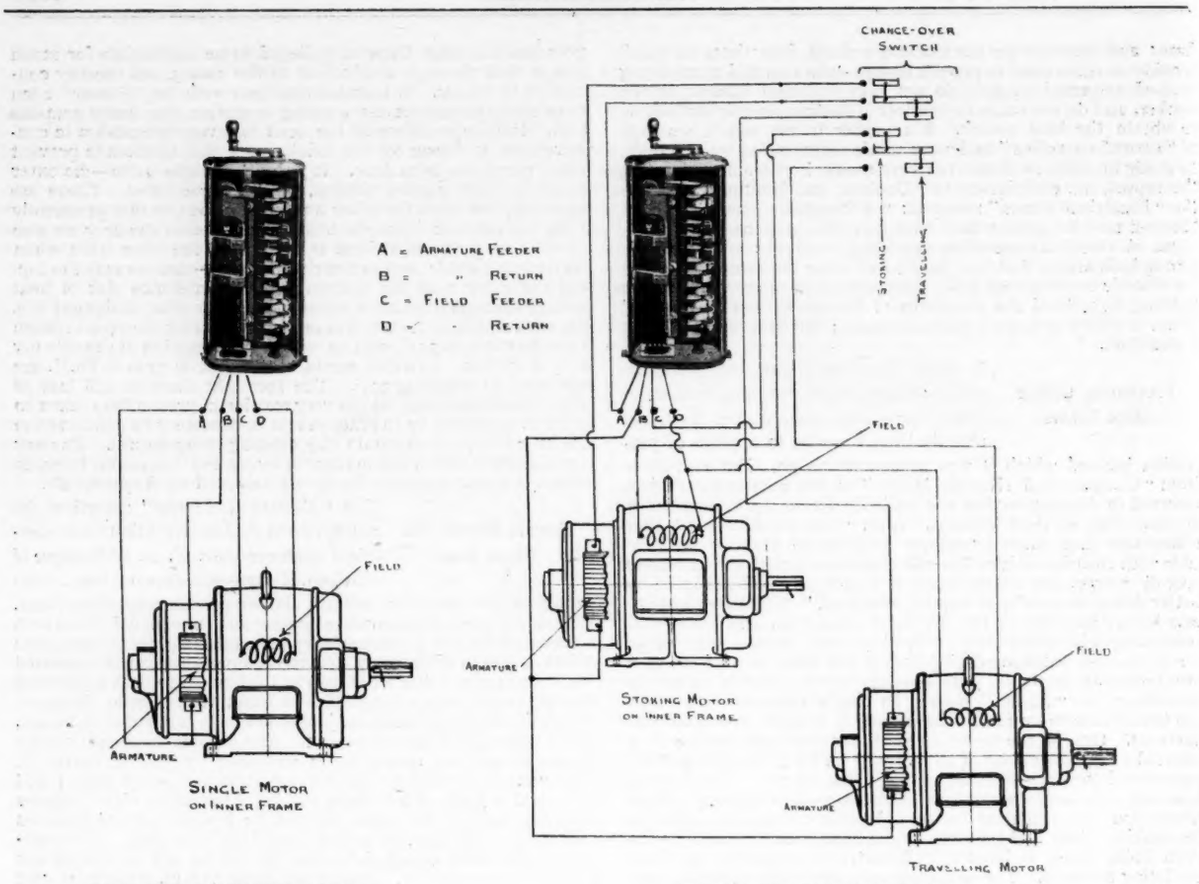
The machine is now ready for the reception of the new travelling motion gear-box; and the two pieces of I section joist, on which this rests, may be bolted in their respective positions on the sill-plate, and the lower half of the gear-box bolted thereon. This having been done, the short vertical shaft with its worm-wheel must be lowered gently into the bottom half of the gear-box, and its lower extremity guided through the vertical shaft-bearing bush (through the sill-plate), and driven into the bevel-wheel E, to which it has already been fitted.

Nothing now remains but to replace in the gear-box the worm itself, with its thrust-plates and driving spur-wheel, and put on the top cover. If the wooden template has been accurately made and applied to the sill-plate, it will be found that the driving pinion on the motor-shaft is in accurate mesh with the spur-wheel on the worm-shaft of the gear-box.

The machine may now be put to work; the change-over switch being used in lieu of the travelling and charging clutches. It will at once be found that, whereas these clutches took a not inconsiderable time and a certain amount of skill to operate, the change from stoking to the travelling gear on the altered machine can be made in less than a second.

Care must be taken to only operate the change-over switch when the main controller is in the "off" position. If this precaution is neglected, it will be found that the fingers and contacts of the change-over switch will become burnt. If so desired the change-over switch can be fitted with an electrical interlock, which will only permit of its being operated when no current is flowing in the motor circuits. But, in the writer's opinion, this is a superfluity and introduces complication. If the change-over switch is found to be burnt at the contacts, it can be taken for granted that the operator is to blame, and should be dealt with accordingly.

For the first few days, the new gear on the sill-plate should be carefully watched for any signs of working loose; but this is not likely to occur if a good heavy type of spring-lock washer has



Standard Single-Motor Installation. **Standard Two-Motor Installation.**

DIAGRAMS OF OLD AND NEW CONNECTIONS.

been used on the holding-down bolts, and particularly on the bolts attaching the lower half of the travel gear-box to the two joists on which it rests.

On the machines under the writer's care advantage has been taken of the two-motor lay-out to fit a safety attachment in the form of a simple commutating device on the chain-wheel shaft, the object of which is to render it impossible to travel the machine when the chain is in the retort. This is, however, not an essential portion of the design; and while the writer would be glad to supply anyone interested with full particulars as to its design and operation, he does not propose to include any detailed description of the device in the present article.

In conclusion, the author desires to express his thanks to Mr. P. S. Hoyte, the Chief Engineer of the Plymouth and Stonehouse Gaslight and Coke Company, for the permission which has enabled him to publish these details of a particularly interesting job.

MANCHESTER DISTRICT INSTITUTION OF GAS ENGINEERS.

DISCUSSION ON COAL CONSERVATION IN RELATION TO GAS MANUFACTURE.

WHEN giving an account, in last week's "JOURNAL," of the formal business transacted at the recent quarterly meeting of the Institution in Manchester, it was stated that this was followed by a discussion opened by Mr. Tim Duxbury, of Oldham, on "Coal Conservation in Relation to Gas Manufacture." We now give a report of this portion of the proceedings.

Mr. DUXBURY said he need not sympathize with any of them as to the position they were in with respect to their coal supplies for this winter, and he need not remind them of the very difficult position they were in. It was a question of conserving all the coal they possibly could; and the reason why he promised to open the debate that day was that the subject was one of such importance, and there were so many gas engineers who were doing their utmost to save coal, and to help their country all they possibly could, that he felt it would be an opportune time for a good discussion on the matter. No doubt half the members present that afternoon could say something on the subject; but there was one thing they were determined upon—they were out for winning the war, and they were out for helping the country all they possibly could. He did not think there was a profession anywhere that had done so much for the country and for the war as the gas profession; and he did not think there were any officials of any profession who had worked so hard and sacrificed so much—both of time and money—in order to help the Government in every way. He thought they might take it almost that they had practically won the war (on the land, the sea, and the air); but they had not won the war in this country. It was going to be a very difficult matter to get through the winter with their coal supplies; and that was why he considered the subject of coal conservation an interesting and important one.

It was not his intention to touch on any particular plant, but simply to give the experience they had had at Oldham. It so happened, however, that most of the experience had been on vertical retorts; but, of course, there were other systems in vogue for conserving coal. Many engineers were steaming their horizontal retorts, inclined retorts, and mixing blue water gas, &c. There were so many ways and so many plants that could be brought into play for this purpose that, because he spoke that afternoon mostly on vertical retorts, it was not because he did not think there was plenty of scope in other manufactures. It was not a matter of justifying any plant, or in any way speaking of any particular plant, but more the general subject of coal conservation. He had not prepared any paper, as he had not had time—in fact, it was only at the beginning of the week he started to collect his notes—notes that he had been preparing for six or eight months. Taking their position at Oldham, in October, 1916, they started the winter with 30,000 tons of coal in stock—the largest stock they had ever carried; and they finished the winter (April, 1917) with only 2000 tons in stock. This meant that they had to take 28,000 tons from stock during the winter; and they could not help themselves. The following winter (October, 1917) they started with 21,000 tons in stock, and they finished up the following April with 2000 tons; taking 19,000 tons from stock. Last October they started the winter with only 9000 tons; so that how they were going to save either 19,000 or 28,000 tons as in previous years became a very serious problem. In March last, therefore, they decided to see what they could do

for themselves. They could not get help from anywhere else; and some of their coal had been taken away and steam coal had been substituted. Since March 25, on all three works—Oldham Central, Higginshaw, and Hollinwood—they had saved 8500 tons of coal (4500 tons in the June quarter and 4000 tons in September) out of 9000 tons they had in stock. They really started coal conservation in March, 1917, by making blue water gas at their Hollinwood works; and they made 111,000,000 c.ft. of blue water gas, or about 15 p.ct. of the make at these works. In addition to that they were steaming on Glover-West vertical retorts at the same works. The amount of blue water gas he did not know, but it was probably about 10 p.ct.; and they were prepared to put in 25 p.ct. of blue water gas at these particular works. In this way they saved 10,000 tons of coal in the ten months. The calorific value of the blue water gas was 290 B.Th.U. gross; and the mixture sent out was 516 B.Th.U. About 3000 tons of coke were used.

Their prospects in March, 1918, were so serious that they had to go further; and they decided to experiment at their Central works, with the Dempster-Toogood vertical retorts more particularly. The Central works were selected so that he could give the experiment his careful attention—he happened to be without a Works Manager there, too. With the help of his Chemist, however, who had been most assiduous in carrying out investigations, he had been able to arrive at some valuable data. He looked at the matter this way: That for every thousand cubic feet of gas they got more per ton of coal carbonized on their works, they would save 10,000 tons of coal per annum. This was a very serious matter; and although they had to bring down the calorific value it was worth doing, for, by making 2000 or 3000 more cubic feet of gas than formerly, they would save 20,000 or 30,000 tons of coal. Their previous practice at the Central works had been—since vertical retorts were erected in 1914—to steam anywhere from 10 to 20 lbs. of steam in the verticals; and the following figures would show the progress:

Gas Made per Ton of Coal with 10 to 20 lbs. of Steam on Dempster-Toogood Vertical Retorts.

Year ended March.	C.Ft.	B.Th.U. Gross.	Multiple B.Th.U.
1915	12,318	577	7,107,486
1916	12,861	561	7,215,021
1917	13,168	552	7,268,736
1918	13,416	535	7,177,560

On March 25 they started a different system of carbonizing. The coal was a good Yorkshire screened pea nuts and washed pea nuts—a good coal, as good a coal as could be bought; and they got 15,804 c.ft. to the ton, with a steam pressure, through a ¼-in. orifice, of 20 lbs., and a coal throughput per retort of 4 tons 12 cwt.; the calorific value of the gas being 508 B.Th.U. gross. [see Table No. II.]

decrease in the calorific value of from 477 to 451 B.Th.U.—a decrease of 22 p.ct. So that while they obtained an increase of 80 p.c. in the make per ton of coal, they got a decrease in the calorific value of 22 p.ct., as tested by the Boys and the "Sarco" calorimeter. If they could maintain these results in all their works—the September results—they would save in twelve months (by supplying 450 B.Th.U. gross or 400 B.Th.U. net) 30,000 tons of coal in a year. And this was what they were striving after. A larger works than Oldham would save more, and a smaller works less. At Oldham they worked their vertical retorts with 1-10th vacuum on the top of the retort or in the foul main; so it was not likely they would draw in a large amount of air or producer gases with so small a pull on the retorts. At the bottom of the retorts, the back-pressure on the bottom mouthpiece was 2-10ths, caused by the steam. If they shut the steam off, they seemed to get the same vacuum on the top as on the bottom.

As to the composition of Oldham "Central" gas, unfortunately their analysis apparatus broke down some months ago, and new apparatus on order had not yet been delivered. His Chemist had, however, rigged-up a home-made apparatus; and this was one reason why he did not care to publish the analysis of the gas unless it was made on a standard apparatus, so that one could thoroughly rely upon the figures. He was, however, able to put before them the following figures [see Table No. III.] showing a comparison of the analyses taken at June 24 and at Feb. 25.

TABLE No. III.—*Oldham Corporation Gas-Works, Laboratory Report, July 3, 1918.*

ANALYSIS OF OLDHAM CENTRAL GAS.

	448 B.Th.U. Gross. Test made June 24, 1918.		565 B.Th.U. Gross. Test made Feb. 25, 1915.
	P.Ct.		P.Ct.
Carbon dioxide	3·8	..	2·28
Unsaturated hydrocarbons	1·8	..	2·10
Benzene	0·6	..	0·27
Oxygen	2·6	..	1·00
Carbon monoxide	14·0	..	8·03
Hydrogen	28·0	..	49·27
Methane	23·0	..	31·42
Nitrogen	16·2	..	5 63
Total inert in gas, CO_2 + O_2 + nitrogen	22·6	..	8·91

Oct. 24, 1918. Nitrogen, 14·5 p.c.; Oxygen, 1·8 ,, ; CO_2, 5·0 ,, ; 21·3 ,, inerts } 472 B.Th.U. gross.

These were the actual figures that they obtained; and the total inerts in the gas (CO_2, O_2, and nitrogen) for the 565 B.Th.U. gross gas was 8·91 p.ct., as against 22·6 p.ct. for the 448 B.Th.U. gross gas. They made another test, just for inerts, the previous day (Oct. 24). The result was: Nitrogen, 14·5 p.ct.; oxygen, 1·8 p.ct.; and CO_2, 5 p.ct.—or a total of 21·3 p.ct.; the calorific value of the gas being 472 B.Th.U. gross. From their experience of the calorific value of the gas that they had been supplying, he had practically come to the conclusion that he did not care what the inerts were, if kept within a reasonable limit, so long as they supplied the B.Th.U. that they said they supplied. Sir Dugald Clerk, at the meeting of the Institution of Gas Engineers in London, speaking on this point said:

> So long as gas producers gave them a certain number of heat units for their money, they did not mind inerts (for gas-engines)—so long as they did not have to pay for them. So far they were quite at liberty to introduce carbonic acid gas for gas-engines, because carbonic acid had what somebody called a poisonous effect on pre-ignition. From the gas-engine point of view, he was quite interested, and very pleased indeed, to hear that the calorific value of gas had come down.

TABLE II.—WORKING RESULTS—DEMPSTER-TOOGOOD VERTICAL RETORTS, OLDHAM.

—	March Quarter, 1918,	Weighed Tests, Each of Seven Days' Duration.								June Quarter, 1918.	September Quarter, 1918.
Tons of coal constructively distilled	5,097	317	258	247	244	169	238	170	160	2,721	1,131
Steam pressure through ¼-in. orifice, lbs.	20	15	15	30	15	17	18	18	25	22	19
Gas made per ton of coal, c.ft.	15,804	19,177	19,837	18,029	19,119	22,017	18,800	21,312	23,521	20,135	22,260
Calorific value, gross B.Th.U.	508	493	485	465	478	487	495	480	460	476	451
B.Th.U. multiple, per ton	8,028,000	9,454,000	9,620,000	8,383,000	9,138,000	10,722,000	9,306,000	10,229,000	10,819,000	9,584,260	9,939,260
Tar per ton of coal, gallons	14·15	23·5	17·6	8·58	13·30	15·74	19·50	17·17	17·70	15·43	20·10
10 oz. liquor, per ton of coal	30·66	41·0	32·40	34·20	31·70	42·10	26·90	29·60	28·20	35·40	37·00
Coal throughput, per retort	T. C. 4 12	T. C. 3 12	T. C. 3 12	T.C. 3 19	T. C. 3 12	T. C. 3 4	T. C. 3 16	T. C. 3 6	T. C. 3 12	T. C. 3 2½	T. C. 2 15
Gas made per retort, c.ft.	72,896	69,073	71,413	71,214	68,828	70,454	71,440	70,279	84,675	62,837	61,818

They commenced about that time to test the samples of their coke from vertical retorts for volatile matter; and he was amazed to find they had such a large percentage left in the coke that they formerly believed was thoroughly carbonized. This was a point which required very careful consideration by all gas engineers, as to whether they were leaving volatile matter in the coke that ought to be in the gasholder. They, at Oldham, proved it was so. After March 25, they made a number of weekly tests—as nearly accurate as they could get; and the results for the June quarter practically confirmed the weekly tests that had been made. In the September quarter [see table] they seemed to have kept it up; and the probability was that they would continue to do so. If they took the increased make per ton from 15,804 c.ft. in the March quarter to 22,260 c.ft. in the September quarter, it showed an increase of about 80 p.ct. in the yield per ton of coal carbonized, and a

They now came to the question of high and low grade gas which they had been making in Oldham; and he ought to say that, previous to the war, they were supplying about 600 B.Th.U. gross—as a matter of fact, it was 599 B.Th.U. for a few years before the war. They had fitted in their laboratory two vertical burners and two inverted burners; and they made a number of tests as to the lighting effect of these burners, as table No. IV. would show.

TABLE No. IV.—*Oldham Corporation Gas-Works, Laboratory Report, Oct. 11, 1918.*

INCANDESCENT BURNER TESTS WITH LOW AND HIGH GRADE GAS.

Gross calorific value of gas, B.Th.U.	691	600	497	447	390
Pressure, inches	31/10	31/10	31/10	31/10	31/10
C.ft. per hour	4·483	4·960	5·714	6 10	6·01
B.Th.U. per hour	3098	2976	2839	2727	2343*

The low-grade gas gives a similar light to that given by the high-grade gas.
* The light in this test was less intense than in the previous tests, owing to the fact that the burner in use was not able to pass enough gas at the above pressure.

At the suggestion of a gas engineer, he made two or three extra tests the previous day with incandescent burners that were bought—ordinary Bray burners such as were used in Oldham—at a shop and fixed exactly as they got them, they got a gross calorific value of gas of 691 B.Th.U. with 31-10ths pressure.

A MEMBER: What about the candle-power?

Mr. DUXBURY: We don't bother with candle-power. We have dropped the candle-power out of our calculations altogether. [Hear, hear.]

Continuing, Mr. Duxbury said he was bound to say this—that they had been supplying 400 B.Th.U. net (450 gross) in Oldham for the last six or seven months, and the lighting effect of this burner in his own house and on the town generally was equal to anything he had ever seen in Oldham; and the gas was considerably cleaner. The mantles never became "sooted;" the bye-pass never got choked; and they appeared to obtain a brighter light from the 400 B.Th.U. gas than they seemed to get from the 600 B.Th.U. gas. His friends in Oldham had told him the same thing—that during the six months their light was, if anything, much better. They were supplying it for three months before anyone knew anything about it—only his Chemist and himself knew. The Gas Committee did not know. There were no complaints of the lighting during that six months. He would like again to quote from Sir Dugald Clerk: "When further experiments were made, he believed that with 400 B.Th.U. per c.ft. they could get suitable flame temperature on the mantle." Of course, everything depended upon this. He was not there to explain the reason of these things, but simply to say that the gas they were supplying in Oldham (400 B.Th.U. gross) was quite satisfactory. They, further, made several tests on cooker hot-plate ring burners. They took the average size cooker, such as was used in Oldham and elsewhere—they tested two or three standard cookers—and fixed a test-meter upon them. After carefully taking thermometer tests of the cold water—each test was made with the same kettle and the same burners, but a different quality of gas—they found, first of all, that with pre-war gas (593 B.Th.U. gross) they used 2·91 c.ft. of gas to boil a quart of water in 9 min. 27 sec.; whereas war-time gas (441 B.Th.U.) took 3·43 c.ft. and occupied 14 min. 57 sec. to boil. The two tests, therefore, showed that the rich gas required 1726 B.Th.U. and the low-grade gas 1521 B.Th.U. [see Table No. V.]. So that on the B.Th.U. basis they were boiling the water on a smaller number of B.Th.U. than on the high-grade gas. They had a large number of flat-flame burners in use at Oldham—at Messrs. Platt's and Messrs. Asa Lee's—and occasionally received complaints from them as to the quality of the flat-flame gas. They tried to get over this difficulty, and made a number of tests as to how many shocks a mantle would stand. As a result of an Oldham man's experiments, a mantle had been contrived that was suitable for machine-shops. They were having some of them fixed; but they did not yet know the results. He himself saw one tested. The mantle stood over 100,000 shocks; and when he took it off it was perfect—nothing the matter with it at all. It, therefore, looked as though they would be able to get over the machine-shop trouble by inventing something of this kind. They were now putting a gauze over the mantle; so that if a man hit it with a tool, he would not damage it.

TABLE No. V.—*Oldham Corporation Gas-Works, Laboratory Report.*

INVESTIGATION OF THE RELATIVE EFFICIENCIES OF HIGH AND LOW GRADE GASES FOR HEATING PURPOSES.

Apparatus used in the Tests: Cooker Hotplate, nine Boiling Burner.

Quality of Gas.	Pre-War, 593 B.Th.U. Gross.	War-Time, 441 B.Th.U. Gross.
Water heated	1 quart	1 quart
Range of temperature	80° C.	81·3° C.
Gas used (corrected)	2·91 c.ft.	3·43 c.ft.
Calorific value of gas	593 B.Th.U.	441 B.Th.U.
B.Th.U. used	1726	1521
Time taken for water to boil	9 min. 27 sec.	14 min. 57 sec.

For gas-engines they had no trouble at all with 400 B.Th.U. net gas. They had thirteen engines on their own works; and he was bound to say they were not having the slightest trouble in working, even at midnight pressure, when the pressure was taken off the town. They found that the valves and pistons were very much cleaner—no carbon on the valves, &c. At their Hollinwood works they had five gas-engines. They made 450 B.Th.U. gross gas, or 400 B.Th.U. net; and the engines ran equally as well with the lower-grade gas as on the pre-war standard gas.

STEAMING IN VERTICAL RETORTS.

He now came to what he thought was a very important matter—*i.e.*, the steaming of vertical retorts, the heats, and the throughput. He had come to the conclusion that: (1) Steam acted as a scavenger, to sweep out and prevent the deterioration of the coal gas hydrocarbons, thereby maintaining the coal gas at the highest capacity for yielding liquid residuals. (2) The blue water gas also acted as a carrier, and washed-out the last traces of volatile matter from the centre of the mass of charge, whereby the yield of coal gas was greater when blue water gas was present than was practically possible when coal was distilled for coal gas alone. (3) The calorific value of the blue water gas generated in enclosed continuous vertical retorts was no doubt higher than when generated in an intermittent water-gas plant, with alternate "blows" and "runs." At Hollinwood, on the intermittent plant, they obtained about 290 B.Th.U.; but he did not know what they got from vertical retorts. He should not be surprised if they did not get more than 350 B.Th.U. To his mind, it was a question of finding the right quantity of steam to be used for any particular plant. The right quantity might be 15 lbs. for some vertical retorts; but it might be the wrong quantity for some other plant. In the March quarter they used 20 lbs. of steam for the whole of the quarter. What he wanted to say was that the throughput—he would not like to say the throughput had more to do with the results than the steaming or the heats; but all three together, if they got them equally balanced, they would, to his mind, get the maximum results from a ton of coal. Taking heats, their average pyrometer reading was 1320° C. in the combustion chamber in the hottest bed of the setting; but striking an average of the temperatures, they had found that 1320° C. was about correct. In making these tests they tried to keep the tests in the combustion chamber similar to the March quarter, and they tried to work the retort in the combustion chamber at about the same temperature. He did not think they were far wrong.

Coming to the throughput, which he thought was probably more important than steaming (or in conjunction with steaming), he was bound to admit that they, as gas engineers, and their friends the contractors, had been entirely wrong in getting out their specifications, and specifying that they wanted a plant that would pass so many tons of coal, or carbonize so many tons of coal, per day per retort. For instance, they took the Glover-West plant and specified 2½ tons per retort, and for the Dempster-Toogood 5 tons per retort. To his mind, this was entirely wrong; they had been carbonizing coal, or causing themselves to carbonize coal, that they had not carbonized. It was this that led him to make tests of the volatile matter in coke.

Mr. Duxbury called attention to a diagram showing the coal throughput. In the March quarter they carbonized 4 tons 12 cwt. per day per retort. As they came down in their throughput, they went up in their make per ton! There was another point of view, as was evidenced by the September quarter with 2 tons 15 cwt. Then they had come too low. He was quite satisfied if they got 60,000 c.ft. per retort; but when they came down to 2 tons 15 cwt. charges, they began to get worse results. It seemed to him that about 3 tons or 3 tons 4 cwt. was about as low per retort for giving the best results, and the multiple, that they should go to.

VOLATILE MATTER IN COKE.

In order to show what he meant by the volatile matter in the coke, he had there that afternoon a few samples; and he asked their perusal of Table No. VI.

TABLE No. VI.—*Oldham Corporation Gas-Works, Laboratory Report.*

VOLATILE MATTER IN COKE.

Date, 1918.	Sample No.	Volatile Matter, per Cent.						
		First Inch.	Second Inch.	Third Inch.	Fourth Inch.	Fifth Inch.	Sixth Inch.	Seventh Inch.
July 30	1	1·2	2 05	2·35	4·15	10·45	—	—
Aug. 9	2	0 9	1·20	1·45	1·70	1·90	3·00	—
Aug. 16	3	0·65	—	—	—	—	—	11·25
Oct. 5	4	0·10	—	—	—	—	5 57	—

Proceeding, Mr. Duxbury said the blue water-gas question was a most important one; but he had to confess he could not get the gas as low as he wanted it. [Laughter.] He wanted to supply 450 B.Th.U. gross gas; but at present he could not get below 460 or 470 B.Th.U., hough he was confident that gas at 400 B.Th.U. net was good enough for any purposes, if proper regulations obtained at the place where the gas was going to be consumed. At Oldham they saved all the coke for 24 hours, and then weighed it from all six retorts—all working beautifully, no hanging-up. They put all the coke together for 24 hours; and then when they

TABLE NO. VII.—*Oldham Corporation Gas-Works, Laboratory Report.*

EXAMINATION OF TAR FROM DEMPSTER-TOOGOOD VERTICAL RETORTS AT THE CENTRAL WORKS, OLDHAM.

1918. Week Ending	Moisture. P.Ct.	Oils.				Total Oils Distillate. P.Ct.	Tar Made per Ton of Coal. Galls.	Through-put Daily. Tons.	Oil per Ton of Coal. Galls.	Oils per Ton of Coal. Galls. on Dry Tar.
		170° C.	170° to 230°.	230° to 270°	270°.					
May 13 . .	4·8	2·60	9·00	14·00	39·60	65·20	19·50	3·80	12·70	13·30
,, 20 . . .	4·4	3·90	13·00	12·50	32·00	61·40	17·17	3·30	10·54	11·10
,, 27 . .	2·4	6·80	12·20	12·60	32·00	64·20	17·70	3·60	11·36	11·64
June 10 . .	5·0	3·20	22·00	8·00	32·80	66·00	19·24	3·65	12·70	13·40
,, 29 . . .	2·6	1·87	15·25	11·37	32 50	60·99	..	3·76	..	..
Oct. 9 . . .	5·9	3·87	13·75	12·25	38·75	68·62	..	..	..	..

got the quantities of coal carbonized and worked it out, they found it came out at 14½ cwt. per ton of coal carbonized. He at once told his people that the figures were wrong—he would have been satisfied with 12 cwt. But since then they had had further tests; and he had come to the conclusion that they were making a good 14 cwt. of coke per ton of coal carbonized, from good Yorkshire coal. These figures had been proved by a series of other tests on their experimental plant. So that the steaming, to his mind, had not taken out or used up anything like the carbon in the coke that he expected to find would be the case. Some of the coke had, in fact, been sent to a number of steel works in Scotland. They had examined it, and had expressed themselves perfectly satisfied with its hardness, density, and quality—with one exception, and that was that the coke was rather small. But for quality it was good enough for their purpose. The idea struck him whether something could not be done to get a much higher price for this coke when used for steel works or other purposes. They were investigating this matter, too, at the present time.

After dealing with the tables showing the tar figures and ammoniacal liquor results, Mr. Duxbury went on to refer to the question of sulphur. They found that they only had on the average about 16 grains of sulphur in every 100 c.ft. of gas. This, like everything else, he said, must be wrong. In the pre-war gas, they used to send out 25 to 30 grains of sulphur per 100 c.ft.; so that their sulphur content was practically down one-half, though they were working at higher temperatures in the retort. Of course, there was only the same percentage of sulphur in the coal; so that if they made 10,000 c.ft. per ton, and then doubled this to 20,000 c.ft., there must only be half the volume of sulphur in the gas. The result was that at Oldham they were sending out gas much more free from sulphur than in pre-war days with their horizontal retorts. "In conclusion," said Mr. Duxbury, "at Oldham we are going to strike out a new line; and, after careful consideration, we are going to cultivate the demand for gas for industrial and power purposes by supplying a low-grade gas at a cheaper rate than coal for boiler firing." He thought there was going to be a tremendous future for low-grade gas, even at 350 B.Th.U. They were going to cultivate gas-furnace work, gas-engines, and domestic fires. They would laugh some day if they came to Oldham as to a health resort; for that was what it was going to be. They purposed to get it down to such a low-grade gas that it would pay them to supply it in bulk for certain purposes at 6d. or 9d. per 1000 c.ft. It was their firm intention to try to do this—if they failed, they failed. When they considered there was 25 p.ct. of gas used for lighting purposes, 55 p.ct. for heating purposes, and only 10 p.ct. for power purposes, and the enormous untapped field they had before them for power purposes everywhere, he thought they would agree that it was about time they began to cultivate and encourage the consumption of gas for power purposes. But, in order to do this, they would have to supply it at such a price as would cut out coal.

DISCUSSION.

The PRESIDENT invited Mr. John West to open the discussion; and hearty cheers welcomed the veteran as he advanced to the table.

Mr. WEST said Mr. Duxbury had given them a great deal of information that he had been hoping to lay before them. In fact, he had put the top stone upon what he had come to the meeting prepared to say. There was one remark which Mr. Duxbury made that he must rectify, and only one—and that was when he said that claims had been made for vertical retorts that could not be substantiated. He (the speaker) had never made such claims. He said what they were doing with vertical retorts, and now Mr. Duxbury and others had done better. He did not think they could get yield of gas and throughput per retort at the same time; but they had to decide the yield and the quality of gas that was required, and work accordingly. The subject of the conservation of coal had been widely talked and written about; and the generally expressed opinion was that if gas could be produced at a low price, it would be the most advantageous fuel of the future for light, heat, and power purposes, besides supplying the country with the additional chemical products that would be required later on. In this case the sanitary conditions of our cities and towns would be materially improved, and a very large quantity of coal now being wasted would be saved to the nation for posterity. The question arose, How was this much-desired saving and improvement to be brought about? Many schemes had been proposed; but in his opinion the gas industry was the only properly constituted authority at the present time able to carry these economical schemes to a successful issue. They were in possession of every city and town in the United Kingdom, and a very large outlay of capital had already been expended with this desired object in view. Some of them had proved beyond doubt the lines upon which very great savings in coal and general success could be achieved. But more preparatory work had got to be carried out before a fair start could be made on definite and universal methods. At the present time a large number of gas engineers were still working under the antiquated candle power standard, which had been condemned in favour of the new and more scientific calorific power standard. There was no doubt that a universally fixed calorific standard would shortly be adopted throughout the United Kingdom. Of course, it must first be ascertained what kind of gas would most readily meet the manifold requirements of the public. This was the crux of the whole matter; and it needed prompt consideration and a definite answer. Undoubtedly the Legislature would require both scientific and definite proof and guidance as to the most suitable calorific standard for all purposes; and it was incumbent on the gas profession to give the necessary proofs. He (Mr. West) was very glad that the Institution of Gas Engineers had taken up this very important research work, and that the previous week the Committee of experts who had been making experiments had given some preliminary results which they had already carried out—results which would no doubt be improved upon as time went on, and after the most efficient appliances and apparatus were available. Two years ago he was of opinion that a 500 B.Th.U. calorific standard was a suitable one. But the past two years of strenuous research work with a body of scientific experts in the experimental work of the carbonizing of more than 3000 tons of coal had modified his views very considerably. The actual results obtained had clearly proved (certainly to his own satisfaction) that a 450 B.Th.U. calorific standard would be the most suitable and profitable for heating and power purposes, inasmuch as this standard would provide cheap gas, and at the same time render it possible to secure from the coal all the valuable products required. It had been decided by friends of his to produce gas and operate very large chemical works which were to be erected immediately after the war on these lines. For lighting purposes, he was of opinion that a calorific standard of 450 B.Th.U. would be quite satisfactory when all mantles were made to suit this standard of gas, and also for heating purposes when efficient apparatus was employed. For gas-engines 450 B.Th.U. gas was very efficient. Sir Dugald Clerk was of opinion that a lower standard would suffice. He (Mr. West) had just been informed that the British Westinghouse Company had been making experiments, and found that with gas of 450 B.Th.U. there was a greater efficiency with their gas-engines than with gas of 560 B.Th.U. Again, Mr. Lawrence Hislop, of Uddingston, maintained that with the lower-grade gas he was now making he was getting a much greater efficiency from gas-engines than formerly when higher calorific power gas was used. He (Mr. West) was anxious that the Institution of Gas Engineers should take up this heating and power question as quickly as possible; and he was glad to learn that an additional chemist had been secured to assist in this important matter. When all these experiments had been carried out, it would enable the Executive of the Institution to approach the Legislature as an important body and indicate on behalf of the whole gas industry what they considered was the most suitable gas to be used for all purposes. When this was done he felt sure that the great work the gas engineers had carried out for the Government in securing benzol and toluol in connection with the war would not be forgotten. They might certainly rely upon the support and assistance of Lord Moulton for any well-considered and proper scheme. The lower the calorific standard decided upon by the Legislature, the greater would be the saving of coal to the nation; and when this was fixed, it would be a very considerable advantage for the manufacturer of mantles, gas-engines, and all gas-consuming heating and power appliances, as they could then all be more efficiently standardized and tested before they left their works. Those present would be aware he had condemned an excess of inert gases being supplied to the public; and it was now stated in the Committee's report upon their investigations that "gases of low calorific value and high inerts were found to be distinctly inferior on all grounds to gases of similar low calorific value but low inerts." He had persistently pointed out this objectionable feature to the profession for a long time past, and was sorry that the pernicious practice was still being continued in some works. To avoid such objectionable gas getting into the retorts engineers should at all times work with a minimum of pressure inside the retort. He had always worked retorts under pressure, and had made big volumes of gas of the best value. Concluding his remarks, Mr. West said: I wish to point out to you that if the Legislature will give us a 450 B.Th.U. standard, it will undoubtedly be coupled with stringent restrictions against an excess of inert gases in the gas to be supplied to the public in the future. This "standard" question is being considered at the present time both in America and Canada; and I believe that a low calorific standard will be officially adopted in both these countries. Many things connected with our business will be changed after the war; and it behoves us to prepare to meet the necessities of the case. We shall require more and different products than formerly; and you will have to make a study of how to meet this different state of affairs and to supply cheap gas for manufacturing purposes. I will give you one illustration of what is going on in this city [Manchester] at the present time, and show you the advantage of

gas for a special purpose. Several engineers were asked by the Government to make a very large quantity of war materials, to do which it was necessary for them to combine to enable them to carry out the work with the greatest dispatch. The question of an adequate supply of gas came into the calculation, as 10,000 tons of steel armour-plate had to be hardened. Fortunately, it was found that a 36 in. main ran by the works where the hardening plant was to be installed; and Mr. Alderman Kay, the energetic Chairman of the Gas Committee, quickly arranged for a 12-in. pipe to be taken into the works where there are fourteen large gas-fired furnaces in operation and four more are to be built. When these are on full work, about 750,000 c.ft. of gas will be consumed per twenty-four hours. I stand here in somewhat of a triple position—I am an engineer, a manufacturer, as well as a large consumer of gas. In the latter capacity, I suggest, on behalf of ourselves and the consumers generally, that you supply us with gas as cheaply as possible; and I am fully satisfied that this would be the best policy both for gas undertakings and consumers, as there is no doubt that all our interests are identical. He heartily thanked Mr. Duxbury for giving so valuable a contribution to the records of the Institution.

Mr. H. TOWNSEND (Wakefield) said that in speaking of B.Th.U. it would be better if they always reckoned them as gross. Mr. Duxbury had somewhat troubled some of them by using the words "gross" and "net." A week ago, in London, he confessed he was a little puzzled (in listening to the various discussions) to know whether "gross" or "net" was meant. As the Legislature adopted the B.Th.U. gross, he thought that, in all their discussions, it would be better if the old-fashioned term was dropped. They had all heard that history had a habit of repeating itself; and he could not help thinking when Mr. Duxbury informed them of his proposal for supplying low-grade gas in Oldham, it was now 34 years since he made a similar proposal to the town with which he then was connected. But his proposal was to turn all the coke into water gas, and to distribute this through separate mains for industrial purposes. Mr. Duxbury's suggestion was that the gas should be used in the firing of boilers; but he himself found that, to compete in the firing of boilers, the gas would have to be sold at as cheap a rate as 3d. per 1000 c.ft. Of course, boilers had now greatly improved. The proposal which he had in his mind (but which he never carried into practice) was that power should be produced by means of large gas-engines. He rather thought he was the first to propose the introduction of very large gas-engines; but circumstances were against him at the time, though large gas-engines had since come in. He thought, however, the time had now arrived for reducing the calorific value of all gas supply—of course, there would always be a restricted market for a cheap gas in certain special areas—and he was quite at one with Mr. Duxbury in advocating a gas of 450 B.Th.U. gross. If circumstances proved that they could get below this, it would certainly be of great advantage. As Mr. Duxbury and Mr. West had mentioned, there was a tremendous field for a cheap fuel; and it was in this direction that the future of the gas industry lay.

Mr. GEORGE HELPS (Nuneaton) said what they were suffering from to-day was that there were too many opinions. If there were 2000 men in the room there would be 2000 opinions; but he was glad to notice from what Mr. West said that these opinions were being reduced. Mr. West had said that two years ago he stood for 500 B.Th.U. gas, and now he stood by a 450 B.Th.U. gas. Two and a half years or more ago he (the speaker) stood for a 350 B.Th.U. gas. To-day he stood for any gas. [Laughter.] And he thought it quite within the bounds of possibility that they would before long be sending out gas of considerably less than 350 B.Th.U. The whole thing was this—the lower the calorific value the more B.Th.U. they could get from a ton of coal; and the more they could get from a ton of coal the more they could afford to give the customer for a penny. This was the crux of the whole thing. Not so long ago he was there telling them that gas could be sold at from 6d. to 9d. per 1000 c.ft., and they thought it absurd. When people spoke of another man's argument being "absurd," they generally admitted to themselves that they did not know what the other fellow was talking about, and not that they knew he was wrong. Mr. West had said that the Gas Investigation Research Committee had reported that inerts in gas were rather a disadvantage. He (the speaker) had not understood that.

Mr. WEST said his remarks were intended to apply for lighting purposes only.

Mr. HELPS said he thought so. Alluding to the electric lights in the room, he said that was the light, and it was "going to be produced with our gas." [Hear, hear.] In tests with a hot-plate burner to do the same work, a 500 B.Th.U. net gas took 1091 B.Th.U. to boil a quart of water; a 450 gas, 1116 B.Th.U.; a 343 gas, 1104 B.Th.U.; and a 150 gas, 1000 B.Th.U. He was not going to make any fuss, he simply put the figures forward as representative figures as to what could be obtained from a gas down to 150 B.Th.U. If this could be done—and he did not think there could be any dispute about it—what remained for consideration? Merely the cost of distribution. It was a positive fact, and those present knew it, that they could get in gaseous form 20 to 23 million B.Th.U. from a ton of coal. And if they could do this, how many B.Th.U. could they sell for something like the price of a ton of coal? At the present time, and for a large number of years, they had been paying £1 for a ton of coal and charging £8 a ton for it. They had got to get out of that. He declared that it was an absurd proposition—an absurd idea—to have in their mind; and the sooner they got rid of it the sooner they would be of service to the public. If they could get these 20 or 23 million B.Th.U. out of a ton of coal, what sort of a future had this country got, and what sort of a future had they got? Something that the country never dreamt of, and something that gas engineers had never dreamt of. The main point was how this could be remedied in the country's interests. The supply of rich gas was hindering, and not helping, the country. This was what he wanted to put to them. He had been trying for two and a half years every department of the Government he could to put aside, if only for the duration of the war, the wretched restrictions in regard to calorific value. The supply of rich gas was killing them and killing progress. Every day for the last three months he had been expecting permission to get along with his proposition, which was that, for the time being, they should be allowed to send out something like a 350 B.Th.U. gas net. He had pinned himself to 350 B.Th.U. for the simple reason that this quality could be distributed through existing mains without excessive pressure; and this gas would, in existing appliances, give the same efficiency as was obtained from any gas distributed in any part of the country at the present time up to 500 or 600 B.Th.U. He had been taken to task for this; and probably the reason was because he had not explained why. His explanation was that the appliances as used to-day were not used to give the best results—they were obviously not set to give the best results or to get the best use out of the particular gas that was being sent out to them. The gas supply from any works varied from hour to hour between anything from 350 B.Th.U. to 500 B.Th.U.; and the consumer could not use his appliances to the best advantage with all these qualities of gas, unless some adjustment was made. The Institution Research Committee did not know the meaning of their own tests, because their results were not obtained as the result of their own work. What he suggested to them was that they should go into the house of any consumer they liked, and take the appliances the consumer ordinarily used and test them and see if they could not boil a quart of water in the same time, and with the same quantity of gas, whether the gas was 350 B.Th.U. or 500 B.Th.U. He would bet any one in the room a hundred guineas it was so.

Mr. ISAAC CARR (Widnes): I take you.

Mr. HELPS: Right! I will take you. I say any appliances will give you this result, generally speaking. If they could send out 350 B.Th.U. gas, they should save 25 p.ct. of the coal, and be selling gas, and making a good deal of profit, at 6d. or 9d. per 1000 c.ft.

Mr. ROBERT WATSON (Doncaster) said he rose to compliment Mr. Duxbury on a very valuable paper. It would be useful to have the chemical composition of Mr. Duxbury's gas, and also of that mentioned by the last speaker, because inerts in either gas might be obviously disadvantageous to the plant, and there would in time be considerable expenditure, due to oxidization.

Mr. R. H. GINMAN (Leek) said the carbonizing plant at the Leek Gas-Works consisted of eight beds of eight inclined retorts (erected in 1900), 20 ft. long by 24 in. by 15 in. at the discharge end, and 20 in. by 15 in. at the charging end. They commenced steaming the charges on July 20 last. Taking the months of August and September they charged 4312 retorts, and used steam, as against 5782 retorts and no steaming for the corresponding period of 1917—a saving in the number of retorts charged in 1918 over 1917 of 1470. The corrected volume of gas made in August and September this year was 27,555,000 c.ft. against 27,273,000 c.ft. in 1917. This was an increased yield of gas in the 1918 period over the 1917 period, of 282,000 c.ft., with 1470 less retorts charged, or a saving of 514½ tons of coal. The best results in yield per ton by steaming were obtained working twelve-hour charges and full retorts, in lieu of the eight-hour charges previously worked. With twelve-hour charges a yield per ton of 19,000 c.ft. had many times been obtained, with a gross calorific value of 460 B.Th.U. For a period of three weeks they had been working eight-hour charges; and the average working results showed 16,000 to 16,500 c.ft. per ton of 490 B.Th.U. calorific value; tar, 14 gallons per ton, specific gravity 1·140; ammoniacal liquor, 48·7 gallons per ton corrected to 10-oz.; and the saleable coke, 9 cwt. per ton. The composition of the gas now being sent out was:

Hydrogen	50·4 p.ct.
Methane	22·6 ,,
Unsaturated hydrocarbons	2·9 ,,
Carbon monoxide	10·6 ,,
Oxygen	·8 ,,
Carbon dioxide	5·2 ,,
Nitrogen (by difference)	7·5 ,,
	100·0

The coals used were best South Yorkshire washed singles; but washed doubles would suit them better by enabling them to get heavier charges. Washed nuts of about 2-in. cube, and practically full retorts would be better still. The average results to date were 16,200 c.ft. per ton of coal carbonized of a gross calorific value of 490 B.Th.U. The average composition of the gas was as previously stated. These results enable them to sell gas at a profit at 2s. 11d. per 1000 c.ft. for ordinary purposes; and 2s. 4d. net for engines. For the year ended March 31 last they sold gas at 2s. 6d. net; and this yielded a profit of 3d. per 1000 c.ft. This method of economizing coal by steaming charges made their present position in coal much easier; and he trusted it would enable them to pull through the winter with credit to themselves besides materially helping the nation and the Coal Controller.

Mr. ISAAC CARR said he had been much interested in the remarks he had heard that day, and particularly to hear of the wonderful results obtained—the increased yield per ton of coal carbonized; and he thought it reflected great credit upon Mr. Duxbury. What he (the speaker) wanted to say was that he was responsible for the gas supply of a large town (not Widnes) where the shortage of coal had obliged them to reduce the quality of the gas to 450 B.Th.U.; and he had had enormous inconvenience as the result. It was this that led him to challenge Mr. Helps as he did. They seemed to forget that for the last 20 years or thereabouts they had had a Mond gas industry in this country, doing an enormous business—it probably went back to the nineties, he was not sure. But what he did want to impress upon them was that they should not lose sight of the fact that they were the custodians—the technical advisers of people owning gas undertakings; and it was their duty to watch that they conserved these mighty financial interests. They, as gas engineers, were responsible for the undertakings; and it would be very easy for them, by running blindly at low-grade gas, to injure to a very serious degree the interests they were trying to conserve.

Mr. J. H. BREARLEY (Longwood), speaking "as one who had no axe to grind," said he was second to none in his admiration of Mr. Helps for his enthusiasm regarding low-grade gas. He had a great admiration for him; but he thought he might have left the Research Committee of the Institution alone. He (the speaker) was a member of that Committee; and he was there to defend it without fear or favour. The Committee's work was put before the Institution with much diffidence; and it was clearly stated that the work was not completed. Let them suspend judgment until the work was completed. It was

being carried out carefully; and there was no desire to decry or condemn any process. What they wanted to arrive at was the truth; and surely they could arrive at the truth without so unedifying spectacles as those they had witnessed that afternoon, although Mr. Helps, when challenged by Mr. Carr, attempted to qualify his statements.

Mr. HELPS said his statements had been put into writing.

Mr. BREARLEY (continuing) said they all admired the efforts of Mr. Duxbury at Oldham; and the figures he had put before them that afternoon were of such importance as to commend them to their careful consideration. He was working with a similar installation to that of Mr. Duxbury; but he had not been able to get 22,000 c.ft. per ton—these figures made his mouth water. His average for July was 16,000 c.ft. of 490 B.Th.U. gross. If he could get Mr. Duxbury's coal, he was sure he could have obtained very high figures, as he was working with different qualities of coal. He was sure there was a great deal in the steaming process in regard to getting a greater yield of B.Th.U. He agreed with Mr. Carr that gas engineers should not be too precipitate in the matter, but watch things carefully. His (Mr. Brearley's) inclination was to the view that they would in the near future be distributing a new standard gas of 450 B.Th.U.

Mr. S. MEUNIER (Stockport) also complimented Mr. Duxbury on his address. They, too, had been doing their little "bit" at Stockport in the way of coal conservation, for they had begun steaming in inclined retorts; but he had been doing this for so short a period that he had no definite figures at the present time. With regard to Mr. Ginman's statements, he could entirely corroborate that gentleman.

Mr. G. S. FRITH (Runcorn) said that since March last experiments had been conducted with a view to securing an increased make of gas per ton of coal carbonized, by the introduction of steam into their retorts during carbonization. The retorts were horizontals set in beds of six through retorts, 22 in. by 16 in. semi-⏢ section, 20 ft. long, with 6-in. ascension pipes fitted with anti-dips at each end of the retort, and emptying into a "Standard" type hydraulic main. They were charged with a Drakes combined machine. The weight of coal per charge of twelve hours averaged 12 to 12½ cwt., and the make of gas per ton of coal prior to steaming was 10,750 c.ft. over the twelve months ended Dec. 31, 1917, with Lancashire slack. When steaming was first tried four through retorts only were steamed out of twenty-four under fire, or 16⅔ p.ct. of the total. The make of gas increased to 11,700 c.ft. at once, and from time to time further retorts had been adapted to steaming until the make per ton had increased from 10,750 c.ft. over the 1917 figures to an average of 12,761 c.ft. for the six months ended Sept. 30. Since the latter date, a further increase had been recorded; to-day's figures averaging 13,500 c.ft. of gas per ton of coal carbonized. The best method of working, after various experiments, was as follows: The top retorts were not steamed—the coke being used to feed the furnaces. The middles and bottoms were taken in pairs. One retort was charged with 12 to 12½ cwt. of coal, and carbonized for nine hours. The dip on the discharge side was then closed; the gas being taken off by the ascension pipe on the charging side. Steam was then admitted for three hours, when two-thirds of the coke was discharged. The retort was then refilled with coal, and steaming resumed for a further period of twelve hours, when the retort was discharged, and the same routine carried out. Steam was admitted to the retorts from the discharge side, at a pressure of 30 lbs. to the square inch, through a ferrule having a ⅛-in. orifice, connected to the side of the mouthpiece. These results had been obtained without any appreciable reduction in the throughput per retort—an average of 15,000 c.ft. per through retort per day being maintained. By reducing the throughput of coal per retort and steaming for a longer period, a higher make of gas per ton could be obtained. But this would necessitate extra retorts being fired; and any advantage gained by an increased make per ton would no doubt be lost by the extra labour costs involved. During the whole of the experiments under working conditions, the gross calorific value had been maintained at 490 to 500 B.Th.U. with a Lancashire slack having a varying ash content from 31 to 12 p.ct. From the short time the process had been in operation, there was every indication that an increased yield of ammonia would be obtained. A benzol extraction of 1·5 gallons per ton of coal carbonized had in addition been obtained during the period of these experiments—82 p.ct. at 160° C.

Mr. ISAAC CARR said many of them were interested in the steaming of horizontal retorts. What he would like to ask was whether the retorts were full, and whether the steam was superheated.

Mr. JOHN BOND (Southport) asked Mr. Frith whether he found that the benzenoid hydrocarbons had been mixed with any extra paraffin.

Mr. FRITH said they had practically had the retorts packed, and for a period they had been having 24-hour charges. They did not superheat at Runcorn, but got the steam as dry as possible. As to hydrocarbons, he could not answer Mr. Bond's query. He would be pleased to show any of them over the plant at any time.

Mr. BOND said their thanks were certainly due to Mr. Duxbury for the way he had brought forward this most important matter for discussion. He was afraid that if they were all to save the 25 p.ct. of coal the Ministry of Munitions would go short of the products that they required for the prosecution of the war. He maintained that every ounce of coal that was possible should go through the channels of the gas departments of the country, because it was only through these channels they could be economically treated. Mr. Duxbury had told them he had saved 30,000 tons of coal. If these 30,000 tons of coal were supplied to the domestic household, then 80 p.ct. of it would be wasted. With regard to higher makes of gas per ton of coal, there was this to be said—that they lost a certain amount of fuel oil; and fuel oil was needed for the Navy.

Mr. H. E. BLOOR (York) said they were all out to do the best they could for the country; but the difficulty was to know from which department of the Government they were going to take instructions. The Coal Controller asked them to conserve coal, and the Ministry of Munitions asked them to increase the production of toluol to the utmost of their power. In a conversation which he had with a gentleman in London the other day, who was connected with the department of the Ministry of Munitions concerned with the production of ammonia, he told him that they were enormously short of sulphate of ammonia. He (the speaker) told him he had reduced his coal 25 p.ct. by putting in blue water gas, and pointed out to him that the policy of the Coal Controller in withholding coal from gas-works was compelling them to reduce the output of the very munitions which they required. He thought it was time that the gas industry had an authoritative statement on the subject—that the Ministry of Munitions should say whether they really did, or did not, want the products they were supplying them with. Referring to the Coal Controller and the gas industry, Mr. Bloor said the Controller had himself said his great difficulty had been to hold the scales evenly between the various interests involved; but he thought the Controller leaned a little to the coal dealer as an industry and to the electrical industry as an industry, and that he had not had any regard for national interests in this matter. It happened, however, that the national interests coincided with their interests in this matter; and in increasing their output of gas the national interests were advanced. All these and other points had been submitted *ad nauseum* to the Coal Controller's Department. Coming to the point of the paper, he did not know at this moment whether the interests of the nation which Mr. Duxbury was so anxious to serve were being really served or not; and for this reason it was necessary to have an answer to the question. It was vital to their future, it was vital to the interests of the country, to know whether the products relating to the distillation of coal should be obtained. The time had come when some reliable statement should be given—an authoritative answer to the whole question. The crux of the question rested with the Coal Controller, and especially now that they were faced with the Household Fuel and Lighting Order.

The PRESIDENT said he hoped if any members had prepared any written contributions to the discussion that they would be handed to him at the close of the meeting.

Written contributions to the discussion were handed in by Mr. A. E. Mottram, of Ossett, the President-Elect, and Mr. H. Kendrick, of Stretford; the President requesting other members who desired to do so to forward their notes to the Technical Press, as, owing to the lateness of the hour at which the proceedings concluded, it was impossible to go further into a most interesting and profitable subject.

Mr. A. E. MOTTRAM (Ossett) wrote that about five years ago at Ossett he was getting 11,200 c.ft. of gas per ton with horizontals; while for the last four years they had made all their gas in intermittent verticals—averaging 14,000 to 15,000 c.ft. per ton of 540 B.Th.U., with steaming. The previous day their test result was 577 B.Th.U., which was above the average. It was rather interesting to-day to remember that Mr. Thomas Settle, at Exeter, a good many years back, with his original retorts showed a conservation of coal of 25 p.ct. He jumped from 10,500 to 13,250 c.ft. of 14·72-candle power gas tested in the No. 1 burner, and about 600 B.Th.U. He (Mr. Mottram) had that week had the privilege of going into some figures (which would very shortly be published), showing a further conservation of coal of 25 p.ct., with a gas of 500 B.Th.U. This was another big step forward; and he thought it proved that the prospect of a great saving in coal in the near future was a very bright one.

Mr. H. KENDRICK (Stretford) wrote that he had for the last seventeen months been distributing a mixture of coal gas and blue water gas, varying in proportion from 14 to 22 p.ct. The plant in use was horizontal machine-charged retorts and an "Economical" water-gas plant. The calorific value of the mixed gas, after being stripped, averaged 470 B.Th.U. Owing to the poor quality of most of the coals carbonized, they were finally compelled to reduce the proportion of blue gas to 16 p.ct., as the calorific value of the mixed gases after stripping dropped to 440 B.Th.U. The coals in use were mainly slacks of second and third class gas coals, with an admixture of coals that were no better than steam coals. No cannel had been used since April last; and no gas oil since February. They had been able to maintain a fairly uniform quality of gas of the calorific value stated. The coal gas varied between 540 and 570 B.Th.U., according to the kind of coal being delivered; but they endeavoured to mix the gas as much as possible. This was not now possible to a great extent, owing to shortage of labour. The make of gas from these coals averaged from 11,200 to 11,300 c.ft. per ton; and the inerts amounted to 18 p.ct.—being 13 p.ct. N_2, 4 p.ct. CO_2, and 1 p.ct. O_2. The crude benzol washed from the gas was 1·4 gallons per ton. With these gases the flame temperature (judged from the illumination obtained from the incandescent burner) was high; but the effect on a gas-fire was not altogether satisfactory. The brilliance of the fuel did not appear to be so high as with higher quality gas. During the past month he had been using a larger percentage of water gas, coloured with a little oil. So far, the results were satisfactory. The partially carburetted water gas averaged 24 p.ct.; and the oil used was 0·45 gallon per 1000 c.ft. of water gas. The calorific value of the gas averaged 365 B.Th.U. The make of coal gas remained the same as before; and the calorific value of the mixture, after stripping, averaged 455 B.Th.U. The amount of crude benzol recovered was 1·35 gallons per ton of coal. As to the financial results. The figures he had taken out showed that with the present costs of coal, oil, and labour, and the value of the residuals, the carburetted water gas as now being made was no more expensive than coal gas of a slightly higher heating value. But if the oil used was increased above 0·5 gallon per 1000 c.ft. of gas made, the partially carburetted water gas would be more expensive than coal gas. This method of gas making saved coal at the gas-works, and would allow of a larger volume of gas being made per ton; but as to whether it would be a saving of coal to the nation was another matter. The gas sent out would displace some solid fuel; but the reduced quantity of coke for sale owing to the lessened production and increased usage in the gas-works would cause an increased demand for coal as fuel in other directions. As far as he had been able to calculate roughly, there was no saving of coal to the nation unless they were allowed to send out gas of lower calorific value—say, about 420 B.Th.U. gross, the results obtained from which gave great promise.

RESOLUTIONS APPROVED.

The PRESIDENT said Mr. Bloor was very anxious to propose a resolution on the lines on which he had spoken; and the members would

be glad if he would frame a resolution to the Coal Controller and to the Minister of Munitions (the Rt. Hon. Winston S. Churchill).

Mr. BLOOR then proposed that the following resolutions be forwarded; and Mr. S. TAGG (Preston) seconded—the last-named remarking that the gas industry had gone as far as it usefully could with the Coal Controller's Department. They should not have been left in this position.

Mr. MEUNIER said, on behalf of the Lancashire Commercial Section of the Institution, he should like to support the resolutions. He had himself already written to the Minister of Munitions, on behalf of the Commercial Section, asking as to how best they could carry out their suggestions for supplying the various products needed for national purposes.

Mr. KENDRICK also supported the resolutions.

TO THE COAL CONTROLLER.

That, in view of the anticipated great reduction in the output as the result of the operation of the Household Fuel and Lighting Order, the Coal Controller be requested to take immediate steps to ensure the maintenance of the consumption of gas either by at once increasing the gas equivalent to 30,000 c.ft. to one ton of coal or by abolishing all restrictions on the use of gas. It is desired to point out to the Controller that the policy of his Department in compelling gas-works to reduce the quantity of coal carbonized and increase the manufacture of water gas necessarily involves a great reduction in the production of products which are urgently required in increased quantities by the Ministry of Munitions; and this effect will, it is feared, be greatly increased by the reduction of gas consumption through the Household Fuel and Lighting Order. It is thus apparent that the requirements of his Department are in direct conflict with those of the Ministry of Munitions; and in order to enable the industry to comply with the wishes of the Ministry, it is essential that all gas undertakings should be assured of the supply of as much coal as they can carbonize.

TO THE MINISTER OF MUNITIONS.

This meeting of the Manchester District Institution of Gas Engineers, called together for the purpose of discussing the subject of "Coal Conservation in Relation to Gas Manufacture," desires to ask the Minister of Munitions if he wishes the gas industry to maintain the output of benzol and toluol for explosives, tar oils, and ammonia, and, if so, what steps he proposes to take to that end. It is desired to point out that the reduction in the quantity of coal carbonized owing to the necessity of manufacturing water gas to save coal and the anticipated reduction of from 15 to 20 p.ct. in the gas output as the result of the operations of the Household Fuel and Lighting Order necessarily involves an immense reduction in the production of the above products.

THE PRESIDENT ELECT.

The PRESIDENT announced that the report of the Scrutineers showed that Mr. A. E. Mottram, of Ossett, had been unanimously elected President for the 1918-19 Session.

VOTES OF THANKS.

Mr. DUXBURY briefly expressed thanks to the members for their interest in his remarks.

Mr. A. L. JENNINGS returned thanks on behalf of the Scrutineers; and the meeting closed with a cordial vote of thanks to the President.

Mr. Isaac Carr and Mr. Helps.

With reference to the incident recorded above, Mr. Isaac Carr has addressed the following letter to the President of the Institution.

Widnes, Oct. 26, 1918.

Dear Mr. President,—Alluding to the incident between Mr. Helps and myself at the meeting of the Manchester District Institution of Gas Engineers, in Manchester, on Friday, the 25th inst., arising out of Mr. Helps's statement that gas of 350 B.Th.U. is as good for boiling water, when employed in the average type of boiling burner in everyday use, as gas of 500 B.Th.U.; that it will perform the same duty in the same time, even if the inerts in the lower quality gas may consist of air; and that he was prepared to put down a hundred guineas (against anyone in the room) to prove his statement.

As I regard Mr. Helps's contention as a physical impossibility, I accepted the challenge in the matter of the hundred guineas; and I now desire to make some observations in relation thereto. The first of them must be an expression of extreme regret to you and the members for having associated myself with Mr. Helps in this matter, at such a time and place, as I regard it as being beneath the dignity of an Institution such as ours that members should descend to monetary challenges in order to give effect to their views.

There is a licence to debate; and the bombastic fashion in which Mr. Helps (in my opinion) overstepped this licence gave rise to my resentment, and prompted me to take up the challenge.

Having said this, I desire to add that I am none the less anxious that an effective demonstration should be made of the difference between us; and if the Committee of the Institution can see their way, I would like them to arrange for some independent and competent person to make the demonstration, and report to them.

As it will cost money to give effect to this, I assume that Mr. Helps would agree to the cost being deducted from the amount paid in by me, in the event of his figures being proved; and, on the other hand, Mr. Helps will bear the cost if his figures are not sustained.

With this end in view, I beg to enclose herewith my cheque for a hundred guineas, and shall be extremely obliged if the Committee will undertake to deal with the matter. Personally, with regard to the conduct of the demonstration, I am prepared to leave myself unreservedly in the hands of the Committee.

In the latter part of the proceedings, it will be remembered that Mr. Helps interposed—saying that he was "indebted to me for having given him the opportunity of demonstrating what he had stated." My view, however, is that neither Mr. Helps nor myself can have any part in any demonstration, other than that of defraying the cost, in accordance with the result.—Yours faithfully,

(Signed) ISAAC CARR.

Coke as Fuel for Steam-Wagons.

In appealing, through the columns of "Motor Traction," for an improvement in steam-wagon design, a "Fuel Specialist," dealing with solid fuels, after remarking that the fixed carbon is by far the most important heating element contained in these fuels, gives the following as the proportions of fixed carbon present: Anthracite, 95 p.ct.; good average quality coke, up to 90 p.ct.; bituminous coal, 50 p.ct. Each pound of fixed carbon requires, in practice, for its efficient combustion, about 15 lbs. of air; but the air required to consume completely the volatile gases (which begin to distil off below the ignition temperature) is usually considerably more than double this amount. Any attempt to burn bituminous coal—or, for that matter, coke, or intimate admixtures of bituminous coal and coke—under conditions of grate area and draught designed for anthracite Welsh coal, must lead to inefficiency and disappointment. Yet it is within knowledge that such attempts have been made without any modification whatever to the elementary factors of draught, primary or secondary air supply, or effective grate area. Recently published official fuel tests prove that the net thermal efficiency obtained with eight different kinds of Welsh, Midland, and North Country coal, on a "Yorkshire" steam-wagon, is only a little over 50 p.ct. A very inferior sample of coke tested, made largely from Somerset coal, and greatly below the average quality produced at gas-works up and down the country, gave an efficiency of about 64 p.ct. A 10 p.ct., saving on a fuel consumption of 1,000,000 tons is well worth aiming at—more especially bearing in mind the amount of gas and other products obtained from each ton of coal carbonized. Designers would therefore be well advised to aim at providing grate area that will enable the driver comfortably to maintain the normal maximum steam output while firing gas coke at a reasonably low rate per grate-foot-hour. The writer concludes: The suggestion sometimes heard, that coke has a more than usual deleterious effect upon boiler plates or tubes, has no foundation in fact. Most steam wagon users are painfully aware of the fact that fire-box repairs are occasionally necessary. The fact that some of the leading wagon-makers, both locomotive and under-type, advocate the use of coke as fuel for their machines, adequately refutes any suggestion that coke has undue wearing effect on either fire-tubes or fire-boxes.

It is stated that, at a meeting last week, the Dundee Gas Committee decided to join the British Commercial Gas Association.

Sir William Plender has consented to act as Honorary Financial Adviser to the Board of Trade. It will be his duty to advise the Board on questions relating to their financial administration, including the financial aspect of any business matters which are, or may hereafter come, under their control.

The one-hundredth session of the Institution of Civil Engineers will be opened this (Tuesday) afternoon at 5.30 p.m., when Sir John A. F. Aspinall, the President, will deliver an address, and will present awards made by the Council for papers read and discussed or otherwise dealt with during the past session.

The Edinburgh and Leith Gas Commissioners have decided to apply for a Provisional Order, extending for ten years from May 23, 1920, the time limited in their 1898 Act for the construction and completion of certain works authorized by the Act. They have also resolved to apply at once to the Board of Trade for the usual Order, under the Gas (Standard of Calorific Power) Act, 1916, authorizing the gas to be tested for calorific power, instead of as at present for illuminating power.

Plants making nitrate of ammonia are given assurance that their product will continue to be needed after the war. Though the sulphate is well known as a fertilizer, says the "Chemical Trade Journal," the nitrate has not been so used. But in tests reported to the French Academy of Sciences, M. Schloesing has shown that if the yield of a given soil without ammonia fertilizer be taken as 100, it is increased to 122 with sulphate of ammonia, and to 123 with nitrate.

The Coal Mines Department have issued revised directions as to the sale of coal, dated Oct. 26, and embodying the various amendments which have been made since the last issue of the directions on Jan. 31 last. The schedules of prices, both for Allied and neutral destinations, have been revised so as to bring them into accordance with prices prevailing at the present time, and do not necessarily represent the relative values of the different coals. The revised directions do not affect sales made prior to Oct. 28.

Typical specifications for bituminous road materials, by Mr. P. Hubbard (Chemical Engineer) and Mr. C. S. Reeve (Chemist), are contained in Bulletin No. 691 of the United States Department of Agriculture, Washington. They are grouped according to the types of material; and following each is a brief paragraph stating the purpose for which the material is intended, its methods of use, the type of road, and general conditions for which it is suited. The methods of test to which reference is made in the specifications, and directions for sampling, are included in the bulletin.

MIDLAND ASSOCIATION OF GAS ENGINEERS AND MANAGERS.

AUTUMN GENERAL MEETING.

A FULL programme had been arranged for the Autumn General Meeting of the Association, which was held last Thursday, at the Grand Hotel, Birmingham, under the presidency of Mr. W. CHANEY, of Birmingham; and though the proceedings were timed to commence somewhat earlier than usual, it was ultimately found necessary to postpone until the spring meeting the discussion of the two papers submitted. After the election of officers for the ensuing year, the proposed reconstruction of the National Gas Council was considered; and emphasis was laid upon the need for the gas industry to meet the new conditions with a united front.

The PRESIDENT (Mr. W. Chaney, of Saltley), in opening the proceedings, called upon

The HON. SECRETARY (Mr. W. G. S. Cranmer, of Willenhall) to read the minutes of the last meeting; and they were confirmed.

NEW MEMBER.

On the proposition of Mr. R. S. RAMSDEN (Leamington), seconded by Mr. C. M'PHERSON (Clay Cross), Mr. Rupert J. Rogers, of Birmingham, was elected a member of the Association.

OFFICE-BEARERS.

The following office-bearers for the year 1919 were appointed:

President.—Mr. A. T. Harris, of Market Harborough.
Vice-President.—Mr. James Duff, of Banbury.
New Members of Committee.—Mr. James Paterson, of Cheltenham; Mr. H. Banks, of Northampton; and Mr. Hubert Pooley, of Leicester.
Auditors.—Mr. C. H. Carder, of Oldbury; and Mr. P. Dougall, of Kidderminster.
Hon. Treasurer.—Alderman W. R. Cooper, of Banbury.
Hon. Secretary.—Mr. W. J. S. Cranmer, of Willenhall.

The PRESIDENT said it was only after a great deal of trouble and persuasion that they were able to induce Mr. Cranmer to retain his office as Secretary for another twelve months. Mr. Cranmer held a rather strong opinion that no executive officer should remain in office too long, and thought that after five or six years in an Association like this it was good to have a change. There might be a great deal of truth in this; but they would be very unwise to let Mr. Cranmer go—at any rate, just now, when there was so much going on in the gas industry.

Mr. A. T. HARRIS (Market Harborough) thanked the members for the honour they had done him in electing him President, and expressed the hope that he would have the benefit of Mr. Cranmer's assistance.

APOLOGIES FOR ABSENCE.

The HON. SECRETARY announced that he had received a number of letters of apology for absence—in one or two cases from members who had had to go to London for another meeting which had unfortunately been fixed for the same day, in connection with the marketing of benzol after the war. Mr. Cranmer said that immediately he learned of this other meeting he wrote to Mr. W. J. Smith, the Secretary of the National Gas Council, and pointed out that the Midland Association meeting had been arranged for several weeks previously; but Mr. Smith in reply stated that the date of the other meeting had been fixed by the coke-oven people, who would be in London that day for other business. Consequently, it was impossible to made any alteration.

RECONSTRUCTION OF THE NATIONAL GAS COUNCIL.

A discussion then took place on the scheme of reconstruction proposed in connection with the National Gas Council.

The PRESIDENT said he felt, as their representative, it was only right that the members should be placed in possession of the facts, so that he might know their views on the subject. To this end, the draft rules had been circulated among them.

Mr. J. FERGUSON BELL (Derby) expressed the opinion that it was highly desirable that the members of the gas industry generally should know what were the opinions of the members of the Midland Association in regard to this matter. They did not want to discuss the proposed rules, but the principle of whether or not they approved of the National Gas Council. The Council was formed to overcome various obstacles arising out of the war; one thing being the need of one representative body with power to deal with Government and other organizations. Their Association was a technical body; and as a technical association, he claimed that they had done invaluable work for the gas industry. If he thought for one moment that the formation of any new National Gas Council would in any way affect the status of any member of a technical body, he should strongly oppose it; but he believed they had everything to gain by such a body, and that by it their status would be rather increased than diminished. They heard from time to time various criticisms of the National Gas Council; but he had no hesitation in saying that, had it not been for the National Gas Council, they as a gas industry would have been in a very much worse position than they were to-day. They knew that the National Gas Council had taken up the question of coal supplies, also the Gas Coke Prices Order, the Household Fuel and Lighting Order, the questions of ammonia and co-operative dealings in connection with tar, priority certificates, and numerous other matters. In doing all this, they had been able to speak to a certain extent as representative of the gas industry; but the necessity that existed for combined action for the protection and the advancement of their industry was just now greater than ever. Hence, it had, to his mind, been very wisely decided at the present time that steps should be taken to thoroughly reconstruct the National Gas Council in such manner that it would be on a very much broader basis than before, so that in future, he hoped, it would represent the whole of the industry. While the effects of individual research and other work done by individual companies and associations were not to be neglected or disregarded (because the advancement of this country had been mainly due to individual efforts and individual associations), yet he thought that what they did want at the present time was one association that could correlate all the efforts of the different associations, and present them to the Government as representing the views of the whole industry. He believed the best interests of the gas industry would be served if they so organized themselves that in the future they could speak with one voice that would not only be distinctly heard, but would be sufficiently powerful to command respect. If they had had a powerful organization of this kind to represent the industry when war broke out, he ventured to say they would not have had all the restrictions put upon them which they had experienced, and that the industry would have been in a far different position than that which it occupied to-day. He was afraid that a long series of years of prosperity had before the war lulled many of them into a false sense of security as to the position of the industry; but in the future they would have to wage industrial war and meet competition such as they had never had to do before. If they were to accomplish this successfully, they would have to reorganize their methods of working and adopt new ideas and new practices; and all their old methods would possibly have to be put on one side. He believed that there was a more brilliant and wider sphere of usefulness for the gas industry in the future than in the past; but if they were going to occupy it, they must take the tide at the flood, and be prepared to meet the new competition and the fresh set of circumstances that would arise. The war, he thought, had shown them the necessity for combined action; and what was required was a truly representative National Gas Council. It was necessary to take immediate steps to prepare for the future. Some of the results of the tragic war had been brought about by the country's unpreparedness. In August, 1914, when Germany made her tiger's spring, this country was totally unprepared in every sense of the word for war, both commercially and from a military point of view; and he hoped now that peace was coming near they would take action to prepare themselves for the industrial war that was bound to follow. His idea was the close co-operation of both corporations and companies. The undertakings that were municipally owned and those that were privately owned ought to be combined in one united body; and they should be careful that there was no division in their ranks. He also hoped that the National Gas Council would include not only the technical side, but the financial, commercial, and administrative sides; and, further, that it would include the makers of the various gas appliances without which it would, of course, be utterly impossible for them to carry on their business. He was afraid that in the past there had been too great a division between the people who used the appliances and those who made them; but now the time had come when they should have one body to represent the whole of the industry. Unless they did have such a body, he was quite certain that they would be building on an insecure foundation. Now, he was there to plead for unity; and he hoped the Midland Association would, with no uncertain voice, say: "What we want is a united Council." He trusted they would see that they were worthily represented, and that the Council was made what it ought to be. They had heard or read the inspiring address by Lord Moulton, and later the one by Sir Halliwell Rogers; and the broad outlook of these gentlemen must have been evident to all of them. If they could get such men as these to join their Council and attend the meetings, it would be a source of strength, and not of weakness, to the whole body. They had too long dissociated the technical from the commercial side, and had not invited the administrative branch to come to their meetings. The result was that the chairmen and committees of large companies and corporations did not know the amount of work that was being done by their staffs. He was confident the new Council would be the means of advancing their interests; and he hoped that one of the first things the Council would do would be to see to the disbanding of the huge army of officials in London who kept on sending out all kinds of regulations. One heard a good deal about demobilization of the military army; but he thought that the first demobilization that should take place was of the army of officials at present in London. ["Hear, hear."] For a long time people had been satisfied to accept these regulations, saying: "Let us get on with the war. Unless we win it, nothing else counts." But now peace was getting nearer; and what they wanted to say was: "Let us once more be masters of our own business, to conduct it in our own way, and by our own methods." He therefore hoped the new National Gas Council would first take steps to see that the army of officials who forwarded all these irritating regulations was put aside. Collective bargaining had got to come. If they were united, they would have strength, and be able to obtain fair and equitable terms. He suggested that the meeting should approve the principle of reconstruction of the National Gas Council, and hoped that the members would give the President their mandate to heartily support the proposals.

Mr. W. A. TWINE (Birmingham) said he trusted the National Gas Council, when reconstituted, would fully recognize such kindred bodies as the Sulphate of Ammonia Association, the Benzol Association, and the Tar Association. It would perhaps be possible for these bodies to join forces, and be represented as a Gas Residuals Committee; for it was certain that there would be much for such an organization to do

after peace was declared. In fact, he would like to see work started immediately. What were they going to do regarding Germany and her synthetic ammonia industry? How could they ensure the Colonies getting sulphate of ammonia and other fertilizers, and at the same time keep Germany outside? This country lost its cyanide industry in South Africa during the Boer war. Let them be sure that they did not lose anything as a result of this war. Rather let them find something—and that something be Germany's 1914 markets. The cyanide manufacturers depended very largely upon the gas industry, which supplied the raw material for its manufacture—namely, ammonia in one branch, and in another ammonium sulphocyanide and sodium ferrocyanide.

Mr. W. M. VALON (Stafford) remarked that, along with Mr. Bell, he was a keen supporter of a reconstructed National Gas Council; but he would like to know whether they were going to have any opportunity, before it was actually formed, of expressing their views upon the final scheme. Were they at the present meeting just to give the proposal their general blessing?

The PRESIDENT: The whole thing is still in the melting-pot, and has not been accepted by the Council themselves. The Council are simply framing a constitution with the idea of coming to you, and saying, "Do you approve of this?" We are very anxious to know that we are going on the right lines.

Mr. VALON: Then I take it we shall later on have an opportunity of saying whether we like it or not. Continuing, he said that to his mind the Association would be well advised in giving the President a mandate to go to London and say they agreed to the proposal to reconstitute the National Gas Council, but making the proviso that, in their opinion, provision should also be made whereby the Society of British Gas Industries should have fair representation on the new Council. He was glad to see that the Provinces were going to have fair representation—a thing that they had not had up to now. But one of the objects of the new Council was to promote or defend the interests of the gas industry of the United Kingdom. How could this be attained, if they left out in the cold an important section of the industry? He was one of those who thought that the time had arrived when the outlook of those on the technical side of the gas industry should be broadened, and when the old prejudice against admitting to their counsels any engineer (although he might be very highly technical) who happened to be connected in any way with what, in their rules, was called trade, should become a thing of the past. They must admit that, in the large engineering firms dealing almost entirely with the manufacture of gas apparatus, there were many men of very high technical ability indeed, and with a business rectitude equal to any of their own members. It must be obvious to all thinking persons that the work of such men and their own work were inextricably interwoven, and that, although to some extent innovations in many matters, would naturally be viewed from different standpoints, yet, when it came to questions of importance to the whole industry—such as would be dealt with by the new National Gas Council—then there could be no doubt that their interests became unified. It might be said that there would be difficulty in deciding how the value of their vote was to be fixed; but he would suggest that there should be no difficulty in this matter. Each gas undertaking's voting power was to be reckoned as one for every 250 million c.ft. supplied in the district; and this represented a known capital value in gas undertakings. Equal votes could be given to members of the Society of British Gas Industries for equal capital value. He understood the principal reason urged against the inclusion of the Society of British Gas Industries on the National Gas Council was that there would be great difficulty in discussing matters as to prices in the presence of representatives of the industries concerned. This appeared to him to be a very poor argument; for surely much more success would be obtained in dealing with matters of this description with those who were fellow-members than with a Society who might feel somewhat antagonistic. He hoped the meeting would agree with him that they ought to do away with these old ideas, and start on a fresh foundation. The time of looking with suspicion upon some of their brethren should be past; and he sincerely trusted the members would indicate, as far as they were concerned, that they heartily supported the new Gas Council, but felt that it ought to embrace the whole of the industry and not parts only of it.

Mr. H. E. COPP (Etruria) said there had already been an enormous amount of speech-making on the subject of these proposals. At a recent meeting, there was an hour-and-a-half wasted in the discussing of an abstract proposal which everyone must have agreed to. Was it conceivable that any member of the Institution should be opposed to the suggestion that it should be represented on such a reconstructed Council? It was not conceivable. It seemed to him that nowadays it was fashionable to say that any co-ordination of industry must be founded on democratic lines. This word "democratic" was very misleading. He was nervous as to whether, with all this reconstruction, they would have at the top of the tree the people to meet the Government Departments and make arrangements with them. They must have some machinery for selecting suitable men; and he took it this was what their duty was in connection with the proposal. Government Departments were very hard to deal with. It was difficult to get them to take any notice of one. If they were to get attention, they must have men at the top of great influence; and he hoped that, as the outcome of all this business they were going through now, they would eventually arrive at a body of men who were qualified to undertake the duty to which he had referred.

Mr. W. J. S. CRANMER (Willenhall) thought that the last speaker had "hit the nail on the head." There was something wanting about the present National Gas Council. It had no doubt done extremely good work, as far as lay in its power; but it was a Council formed to meet an emergency, and it would be re-organized in the light of experiences which had been gained in the past two years. One of the drawbacks to the present Council was the question of finance. It was really dependent upon the charity of the existing bodies. Now, the new proposals provided for a definite income; and he thought the assessment was one which no one could grumble about. Then there was the question of management, which he thought was one of the weakest points of the present Council, who were dependent practically on individual effort. The new constitution provided for the appointment of a man of ability and standing, who would be paid; and the success of the new Council, he thought, would largely depend upon the man who was appointed. It had been mentioned that the constitution did not provide for including all the branches of the industry. Personally, he was quite in sympathy with the speaker who had stated that it was necessary they should work more closely in touch with the Society of British Gas Industries. They had membership under the existing rules, though they were not, he believed, represented on the Executive. There were many very able men in the Society; but they had to remember that the National Gas Council was not so much interested in the technical side as in the commercial—or he might use the term political—side. No doubt the members of the Society would be useful to the industry as a whole; but the question came in whether they should be actually members of the Executive Committee. He welcomed the idea of a Committee of Employers. They had many of them seen recently the advantage of collective bargaining. Some had had experience of negotiations in regard to wages, and had found it had been a decided advantage there. The National Gas Council as now constituted had no power to represent the industry in this respect; but the Committee of Gas Employers, he took it, would be in a position.

Mr. A. T. HARRIS (Market Harborough) said that to his mind it was very important for the gas industry to organize its forces. Parliament had given them relief in many ways to suit their own convenience, simply because it had been to the benefit of the country. They were, however, many of them, working under Private Acts passed a great number of years ago; and they wanted a watching body who would be careful when the war was over that they did not revert to the old restrictions, which were, so to speak, antagonistic to the welfare of the industry. What they needed was a body who would be able to put before the "powers that be" not only the best conditions in regard to the industry, but also in regard to the country. Now was the time to take advantage of the opportunity of obtaining such a body. The Institution of Gas Engineers had not been able to do this, being a technical organization. This was a chance of forming a representative body that would look after the interests of the industry generally, and not only in regard to its technical side. He should be sorry if advantage were not taken of the present opportunity to avail themselves of this chance.

Mr. GEORGE STEVENSON (Long Eaton) thought a meeting would be necessary to formally approve the suggestions, before they were accepted as final. As a member of the National Gas Council, he would say that, though other schemes for reorganization had been suggested, to his mind the scheme for broadening the basis of the whole industry through the medium of the present Council was by far the best one. But it was not a final scheme. He fully believed that every one of the objections that had been raised would be met. It would be very unwise to further discuss the matter. What was proposed was a step in the right direction. The time was ripe for reorganization in many ways; and they should support the scheme now before them with all their might—not be driven on to side-tracks by minor issues, which, after all, could be incorporated in the scheme.

Mr. W. S. MORLAND (Gloucester), alluding to the Society of British Gas Industries, said it would be very much better that the gas undertakings should form the Council; and then there would be nothing to prevent them calling in the help of kindred Societies, if desired. But the National Council should first of all discuss their own matters; and then if it was found necessary to bring in any other bodies, there was no reason why they should not ask for their assistance. It did appear to him that they wanted to look after their own interests first. Was it their idea to bring in the coal industry to advise them what to do? It seemed to him that it would be far better to be free than to tie their hands.

The PRESIDENT remarked that he thought the discussion would be very useful to all concerned. He was particularly grateful to Mr. Bell for the strong support he had given to the scheme. Did he wish to proceed with his resolution?

Mr. BELL: I leave it in your hands. I will, if you think it desirable, move that we approve the principle of reconstruction of the National Gas Council.

The PRESIDENT thought they would all approve of the scheme; but, as Mr. Morland had just pointed out, objection was taken in the matter of the complete inclusion of the Society of British Gas Industries, for the reason that it was very difficult to know where to stop. But this was a matter for arrangement at a later date.

Mr. BELL: I propose—"That this meeting approves the principle of the scheme of reconstruction of the National Gas Council." I do not think there can be any doubt that we want a body on a broad basis to represent the whole industry; and the scheme submitted covers the ground. We can discuss details later.

Mr. VALON: I will second that. I was not, of course, talking of bringing in the coal man, and the man who sells a pint of paraffin, or anything of that kind.

The resolution was then put to the meeting, and carried unanimously.

THE PAPERS.

Mr. H. E. COPP (Etruria) then read some "Notes on Benzol and Naphthalene Recovery" [which will be found on p. 311]. Before doing so, he remarked that, on account of the fact that the members would no doubt recognize some similarity between the phraseology of some remarks made at the recent meeting of the Institution of Gas Engineers and the opening part of the paper, it was only fair to say that he had completed the paper before the date of that meeting.

The PRESIDENT said the members would all agree with him that they were much indebted to Mr. Copp for his paper. The matter dealt with was one of very great importance to all of them, considering the trouble they had been put to. If they could lay hold of the naphthalene in solid form, and take it out of the gas, they would be absolutely sure of its recovery. There was not much time left, and Mr. Copp was agreeable that the discussion should be postponed until the next meeting. They would then be better able to tackle it.

Mr. W. A. TWINE (Birmingham) next read a paper on "Chemical Engineering in Relation to Gas Engineering." Publication of this it has been found necessary to defer until next week.

The PRESIDENT said Mr. Twine had given them a most interesting paper. He was afraid chemistry had been neglected somewhat in gas-works; but they were aware there was a lot of money to be made out of cyanide and chloride of ammonium, and ammonia generally. He felt with Mr. Twine that before long liquid ammonia purification would be accomplished. It had worried engineers and chemists for a good many years; but he thought that what had been done by Mr. Twine, Mr. Smith, and Dr. Davidson had very nearly brought them to the summit. The discussion of the paper would also be postponed until the next meeting.

A hearty vote of thanks was passed to Mr. Copp and Mr. Twine, on the proposition of the PRESIDENT, seconded by Mr. W. S. MORLAND.

NOTES ON BENZOL AND NAPHTHALENE RECOVERY.

By HAROLD E. COPP.

[A Paper read before the Midland Association of Gas Engineers and Managers, Thursday, Oct. 31.]

Nearly every gas engineer, irrespective of the size of the works he runs, has—from that best of teachers, experience, or perhaps as the result of the careful study of any particular phase of our most interesting profession—conceived ideas, and formulated definite opinions, which would be of great usefulness to his fellow members. It was this thought which prompted me, when submitting a communication to the Association some years ago, to urge upon members the desirability of placing any such special information before the Association. The result could not be other than advantageous to all concerned; and there would be greatly added interest in its proceedings.

I am well aware that we have had many thoughtful addresses from our past and present Presidents, as well as several interesting and instructive papers; but I would submit that short and unpretentious communications—even if unadorned by masses of more or less useful data and figures—may not be without value. I, therefore, make no apology for these somewhat disjointed notes, prepared under the exigencies of present circumstances.

Shortly after the outbreak of war, and immediately it became evident that certain products, recoverable only in the process of the distillation of coal, were essential for the manufacture of explosives, the gas undertakings of the country, with few exceptions, responding with alacrity to the Government's request for these products, whole-heartedly devoted their energies to the recovery of them; and, regardless of the possibility of loss, as well as the difficulties and inconveniences of so doing, many installed expensive plant for the purpose. It might consequently be thought that the Government would look with favour upon the gas industry. On the contrary, however, the general attitude of practically every department concerned, with the exception of the Explosives Department (from whom we have received every consideration), has been consistently antagonistic. Coal is probably our greatest national asset; and it is essential in the national interests that all consumers of coal should utilize it not only sparingly, but in the most efficient manner. Now the gas and bye-product recovery industries easily take first places when judged by this standard. Most of the other industries—including the generation of electrical energy—are shockingly wasteful by comparison. Moreover, the gas industry has in recent years made at least as much progress in the science of coal utilization as any other. In view of these facts, it is hard to understand the reason why other industries should be favoured, and the gas industry so crippled as it is being at the present time.

I refer primarily to the very serious position in which those gas companies are placed who operate under the sliding scale. The system may have been just and reasonable under normal conditions; but, in the present circumstances, it seems hardly consonant with that sense of fair play which is one of our national characteristics. The statutory maximum prices of gas are also, in the cases of many undertakings, much too low to meet the difficulties of the situation; the consequences being that shareholders' as well as ratepayers' property is being steadily depreciated in value. I also refer to the fixing of the prices of residual products at figures below their market value by departments who are the purchasers of these products. There is the further fact that large increases of wages are continually being sanctioned, with apparently no thought as to the pockets from which the cost of the same will ultimately come. Indeed, had a similar attitude been adopted towards other industries engaged in the manufacture of munitions, though having no statutory or public obligations to fulfil, there may be some reasonable doubt as to whether the goods would have been forthcoming.

The Directors of the Company which I have the honour to serve were among the first to recognize the necessity of scrubbing coal gas with oil for the extraction of benzol and toluol—the expedient of scrubbing with tar being inadequate to meet the Government's requirements. A plant was, therefore, installed at the Etruria works during the spring of 1916, at the request of the late Sir Corbet Woodall, who was then Chairman of the Board of Directors. The members of the Association inspected the plant in July, 1916, shortly after its completion. It is, therefore, unnecessary that I should again describe the plant in detail,

EARLY TROUBLES.

One of the first difficulties encountered was due to the corrosion of the inner steam chambers of the superheaters near the tops, where the hot oil from the preheaters came into contact with the iron casting heated from the inside with live steam. This corrosion may be due to the action of either cyanogen compounds or to ammonium chloride; but this has not yet been finally determined. It must be remembered that the oil-scrubber is placed at the inlet to the purifiers, as it could not be conveniently arranged at the outlet. Had it been so placed, it is probable that this difficulty would not have arisen. The remedy adopted was that of fixing an outer cast-iron jacket to the steam-chamber; the intervening space being run with molten lead. Wooden strips were also bolted to the ribs of the steam chamber, making a more or less tight joint with the outer casing. This prevented short-circuiting, and ensured a more rapid circulation of the oil through the apparatus. The steam pressure available was 80 lbs. per square inch. It was formerly thought that the higher the pressure, the greater would be the heat in the still; but the steam consumption had necessarily to be cut down to the lowest limit in order to keep down the water content of the oil, and so prevent emulsification. The result was that the sensible heat of the steam was so diminished by its expansion through a small orifice that the heat of the oil in the still was actually lower than that leaving the last superheater and entering the still. Under these conditions, it was only possible to make 50 to 56 p.ct. benzol; and much trouble was experienced through the emulsification of the oil, which had to be continually replaced. A gas-fired superheater was then fitted on the steam supply to the still, which raised the temperature from 104° to 118° C., and effected a great improvement in working for some time. But, owing to its irregular action, it had eventually to be discarded.

TAR DEHYDRATION PLANT.

About the same time it was deemed advisable to instal a plant for the dehydration of tar; and in the spring of 1917 an order was placed with the Chemical Engineering Company, who were the contractors for the benzol plant. The dehydrating plant was so designed that it should be capable of producing wash-oil from tar as well as treating the spent wash-oil for its rectification. It was, therefore, fitted with two condensers in series. The still is of the well-known cast-iron coil type set in brickwork—No. 14 on the plan, p. 312.

The plant when first started-up was used for wash-oil rectification; the temperature of the still being kept at 200° C., and the still pressure at 50 lbs. per square inch. The results were quite satisfactory at first; but trouble was soon experienced through the coil becoming over-heated—presumably due to the irregular working of the pump on the thick emulsified oil. It was subsequently found more convenient to treat a proportion of the wash-oil while the plant was being used for tar dehydration. In this way, all the trouble was overcome; and the plant was found to be capable of working up to a temperature of 230° C., at a pressure of 50 lbs. per square inch—thus producing a satisfactory proportion of middle oils, eminently suitable for benzol extraction. The naphtha which is not suitable for mixing with the benzol is run into tank F, and sold as crude tar naphtha; the light oils being run into tank G. The heavier fractions are run into one of the tanks No. 20, where they are allowed to cool for the purpose of separating the naphthalene. Each naphthalene tank is fitted with a perforated iron plate; and each hole is fitted with a wooden plug. By removing these plugs one by one, the water and various gravities of oil are allowed to run into suction tank No. 21 and thence pumped to where they may be required.

It will be noticed that both the benzol and tar plants are arranged at such levels that gravitation may be utilized to the fullest extent; but pump No. 24 is so fitted that the contents of any one tank may be transferred to any other tank. The tanks are divided by partitions; the contents of each being approximately proportional to the quantities of each product obtained. The partitions of the tanks, and the settling tanks, are built of wire-cut blue bricks set in cement, and washed with cement and Ironite in equal parts. The latter composition has been found capable of resisting the action of any of the products and preventing leakage.

DIFFICULTIES EXPERIENCED.

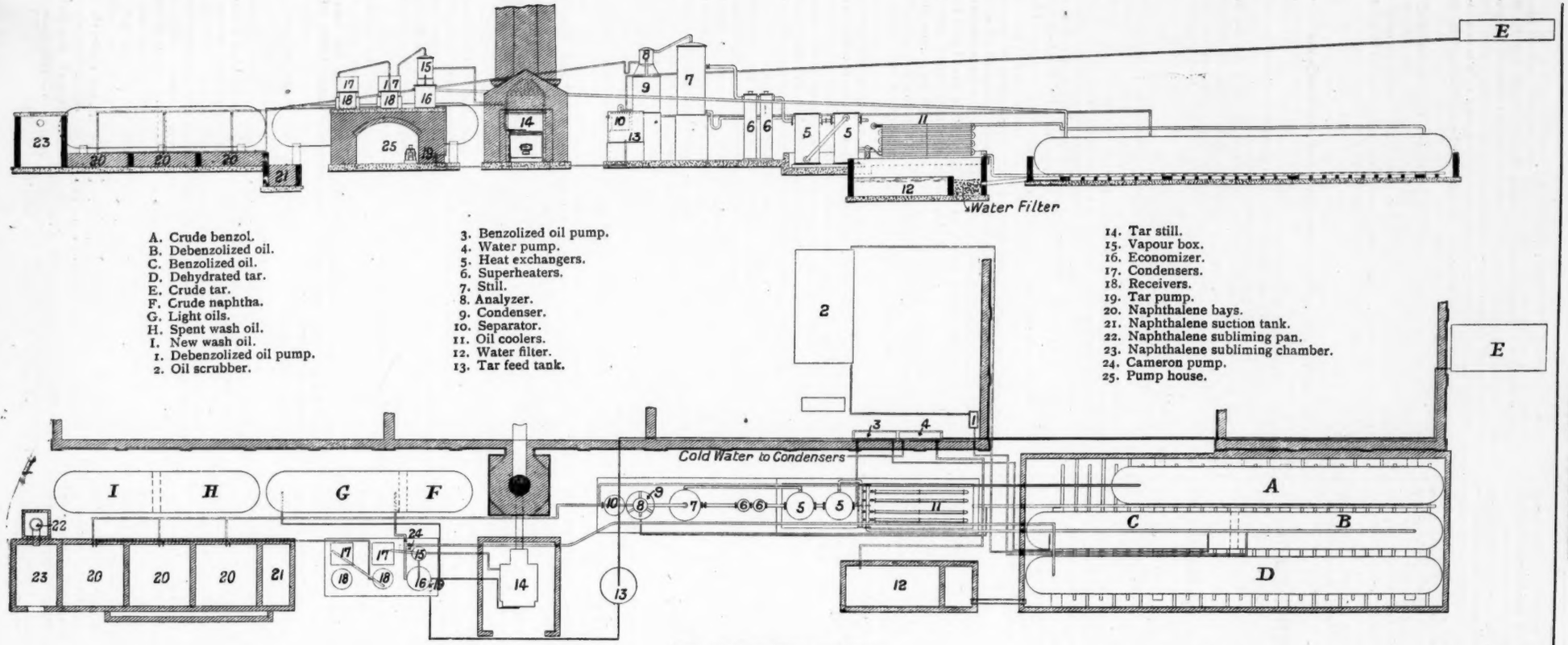
I have previously referred to the difficulty in keeping the wash-oil used for benzol extraction free from water. The new wash-oil was generally found to contain 1 to 2 p.ct. of water; the distillation of the dehydrated wash-oil showing the following results:

Up to 200° C.	8 p.ct.
230° C.	40 ,,
280° C.	60 ,,
300° C.	75 ,,
Residue	25 ,,

After a few weeks' working, its composition altered to approximately:

Water	10 to 20 p.ct.
Dehydrated oil—	
Up to 200° C.	2·2 p.ct.
230° C.	8 ,,
280° C.	41 ,,
300° C.	58 ,,
Residue	42 ,,

This alteration was attributed mainly to the variation of the still temperature consequent on variation of the steam pressure



TAR AND BENZOL PLANTS.

between 60 lbs. and 80 lbs. per square inch. Under these conditions, the quality of the benzol produced was seldom over 56 p.ct. up to 120° C.; and it frequently contained from 30 to 35 p.ct. of creosote—necessitating the purchase of large quantities of new wash-oil. It was then decided to introduce a pressure-reducing valve on the steam inlet to the still, as nearly all the heat necessary for driving off the benzol should be imparted to the oil by means of the preheaters and superheaters before the oil enters the still, and only sufficient live steam allowed to enter the still to carry the vapours over to the condenser. The steam pressure was reduced to from ½ lb. to 1 lb. per square in; and immediately an improvement not only in the benzol produced but also in the wash-oil became evident.

It may here be noted that the preheaters, which contain a large volume of partially heated oil, may be made to act most usefully for the separation of water, which accumulates at the top and should be discharged each day by putting sufficient pressure on the plant to eject it through a pipe fitted in the top of each vessel.

Prevention of Naphthalene Trouble.

There are two well-known methods for the prevention of naphthalene trouble. The first and oldest is that of scrubbing with creosote which in former days was benzolized in order not to rob the gas of its illuminating power, which was then considered so essential. The second method was that of either vaporizing or atomizing mineral oil into the gas, of approximately the same vapour-tension as naphthalene, so that when the naphthalene was in such a physical condition that it was about to be deposited in the mains, the oil was also condensed and held it in solution, so preventing stoppages. A vaporizer of this type has been in use at the Etruria works since the installation of the benzol plant. It was a necessary adjunct thereto, as by the removal of benzol, toluol, &c., there were practically no carriers of naphthalene left in the gas. Indeed, even with this apparatus, it was impossible to judge the exact quantity of mineral oil it was necessary to use in order to prevent naphthalene complaints. Generally, although naphthalene troubles are not usually greatest during the summer months, it was found best to use larger quantities of oil in order to minimize the complaints during the autumn, which is perhaps the most troublesome season, owing to the great variation between the maximum and minimum atmospheric temperatures. Whereas coal gas containing a high percentage of light or unsaturated hydrocarbons will under ordinary conditions carry from 7 to 9 grains of naphthalene per 100 c.ft., it will not carry 1 grain if the benzol is entirely extracted.

It occurred to me that as creosote was used as a scrubbing agent for benzol, it could at the same time be made to extract naphthalene. After a number of experiments, a connection was made at a point near the top of the still, and a certain proportion of the oil run off, which was found to contain a fair proportion of naphthalene. But this method was uncertain, and therefore unsatisfactory.

It was then decided to instal a small supplementary condenser for the purpose of separating the naphthalene fractions from the

crude benzol. This was placed between the still and the main condenser. It is constructed from a section of boiler flue. Each end is fitted with a $\frac{5}{8}$ in. diaphragm, into which about twenty $1\frac{1}{4}$ in. wrought-iron steam tubes are expanded; the end plates being dished to allow of the circulation of water through the tubes. The apparatus is purposely made small, in order that the temperature might be easily controlled. This is constantly kept at 96° C. by regulating the stream of water. If the apparatus had been much larger, there would have been difficulty in ensuring a regular temperature; and it will readily be seen that should this rise as high as 98° C. or fall as low as 92° C., it would be little use for naphthalene extraction.

Another factor in obtaining this close regulation of temperature is, of course, the steam-regulating valve before alluded to. The liquid obtained from this small condenser consists chiefly of water and naphthalene, and is run through a 2-in. pipe in conjunction with a $\frac{1}{2}$-in. steam-pipe (in order to keep the naphthalene from solidifying) to the settling tanks. On cooling, the naphthalene separates out in large flakes on the surface of the water, and subsequently sinks to the bottom. When one tank is full, the stream is turned into one of the other tanks. Whereas the naphthalene obtained from the wash-oil and tar is black, and contains a large quantity of creosote, that obtained from the benzol is fairly pure and yellowish in colour. The liquid is then run off the settling tank, and the naphthalene at the bottom is removed, and placed in a small cast-iron tank. It is then covered with boards, and pressure is applied by means of weights, in order to remove as much of the liquid contents as possible. The dried naphthalene is then placed into a pan, heated with a closed steam-coil and sublimed into chamber No. 23, where it adheres to the brickwork interior in the form of pure white crystals of 77° to 78° C. crystalizing point. This is periodically removed and bagged for sale.

The crude gas at the inlet to the oil-scrubber contains an average of 16·8 grains of naphthalene per 100 c.ft. of gas; and since the supplementary condenser or analyzer was started, the scrubber has absorbed the whole of the naphthalene in the gas. From 24 to 30 lbs.—depending upon the quantity of coal carbonized—are recovered every day, equivalent to 16 grains per 100 c.ft. of gas; the remaining 0·8 grain passing with the crude benzol to the storage tank. It may be noted that when the wash-oil is saturated with naphthalene (though it still continues to extract benzol), under certain temperature conditions, it may give up large quantities of naphthalene to the gas, and so cause much trouble. Before the analyzer was started at the beginning of September, the wash-oil contained from 20 to 25 p.ct. of naphthalene; but it now only contains 6 p.ct. The wash-oil contains an average of 2 p.ct. of benzol at the inlet to the plant, and an average of 0·5 p.ct. at the outlet. The effects of the analyzer have not only been that of keeping the town gas so completely free from naphthalene that its presence cannot be detected with a continuous qualitative test with picric acid, but also that the quality of the benzol produced —though formerly irregular, and averaging about 51 p.ct.—has now risen to a regular 71 p.ct. The wash-oil, too, is kept in far better working condition, and lasts much longer.

BENZOL RECOVERED.

The quantity of benzol recovered has not varied to any great extent. It works out at about $1\frac{1}{4}$ gallons per ton of coal carbonized since the plant was installed—including all stoppages, some of which were of long duration. For six months, only one-half of the oil-scrubber was used, on account of a fractured shaft. This was repaired by sawing a piece out, and fitting two new couplings which were made to form a new bearing. By this means, the dismantling of the machine was avoided.

The total quantity of benzol recovered since the plant was started has amounted to nearly 100,000 gallons—equivalent to 450 tons of high explosive.

THE IMPROVED WORKING RESULTS.

In describing this small addition to our benzol plant, which has been found to be most beneficial, I do not claim to have made any remarkable discovery, as I have recently learned that certain plants of German origin have been fitted with fractionators or other devices which are more or less effective. But I do claim that by its use we have been able to keep our outgoing gas free from naphthalene since it was started early last month. An improvement in the working of the purifiers is also noticeable. On close examination of the oxide, it is generally found that many of the particles are covered with a film of naphthalene which can generally be seen glistening in the light, and which must necessarily impede its working. The material in the last purifier changed, on Oct. 14, showed no signs of the presence of naphthalene. Notwithstanding the fact that at this time of the year our naphthalene complaints have always been most numerous, and that we have not vaporized any oil since the process was started, the complaints have shown a marked diminution, and now cause very little inconvenience. As previously stated, the gas leaving the works has contained no naphthalene since the early part of September, but has nevertheless been found to contain as much as 6 grains per 100 c.ft. at a point two miles from the works—plainly showing that the mains are all being gradually cleared. Indeed, I am confident that—provided the present conditions are maintained, and, except for temporary stoppages, there appears to be no reason why they should not be—naphthalene complaints will soon be things of the past.

Mr. Alwyn Meade in his excellent book on "Modern Gas-Works Practice" says that 10 grains of naphthalene will completely block a $\frac{1}{2}$-in. pipe for a length of 1 ft.; and, further, that one million cubic feet of gas cooled from 68° to 50° Fahr. may deposit as much as 14 lbs. of naphthalene. If this be so, it is easy to imagine the immense amount of trouble which may be caused in a few hours' working without effective means for the control of the naphthalene content of the gas.

If gas is to retain its popularity, complaints must be reduced to a minimum; and as all of us are striving to attain this object, I venture to hope that these few notes may be of some interest to those members whose difficulties have been added to in their endeavours to meet the national requirements.

Calorific Standard Reduction and Consumption.

Discussing in the "Stone and Webster Journal" (U.S.A.) fuel conservation as it relates to the gas industry, Messrs. Nash, Powell, and Vittinghoff point out that, in order to relieve the present fuel shortage, it is absolutely essential that, where high candle-power standards have prevailed, they should be radically changed, and a reasonable heating value standard substituted. While the former candle-power standard required by the State of Massachusetts cannot be called excessive, the action of the Commissioners in establishing a standard of 528 B.Th.U. per c.ft. has allowed the companies operating in the State material relief. It is reasonable to expect that, where a gas company substitutes a low-standard gas for a high-quality gas, the consumer, in order to obtain a given heating effect, must use a greater volume of gas; but experience has shown that, while there is a certain relation between quality and consumption, this relation is not one of simple proportion. In all probability the companies in Massachusetts changing-over from the old candle power to the new 528 B.Th.U. standard, are, on the average, sending out gas of 40 B.Th.U. less power than formerly; but a very careful examination of the consumption per meter of a number of the larger companies does not show any appreciable increase in consumption. The explanation of this apparent paradox, the authors say, lies in the fact that a high-standard gas must necessarily contain a large percentage of hydrocarbon vapours easily condensed by exposure to cold. Therefore, though a company might be sending out a high candle-power or heat-value gas, as measured at the works or testing-station, this gas in transmission would have condensed out of it the most valuable portions, before reaching the distant consumers' appliances, so that the consumer would really be getting a lower quality gas. On the other hand, when the works send out a relatively low-standard gas, its proportion of fixed gaseous constituents is very high, and the proportion of easily condensable hydrocarbon vapours is so low that the gas distributed does not deteriorate materially before reaching the consumer. Every gas-burning appliance has to be adjusted for a gas of certain quality; and this must be for the leanest gas which normally will reach it at any time. Therefore the appliance is never in the position to make use of the high-quality gas to the best advantage when delivered to it. To sum up, it may be said that the efficiency of utilization is very much greater in the case of a low than of a high heat-value gas. When referring here to a "low-standard" gas, a minimum of 450 B.Th.U. or a maximum of 550 B.Th.U. is intended.

Temporary Increase of Charges Act.—The Board of Trade have made an Order under the Act in favour of the Westbury Gas Company, and have received an application for one from the Rochester, Chatham, and Gillingham Gas Company. The Local Government Board have granted an Order to the Prestatyn Urban District Council, increasing their maximum price from 5s. 6d. to 6s. 6d. per 1000 c.ft.

Lille Gas-Works Narrowly Escape Destruction.—The "Progrés du Nord" says that, during the last few days of their occupation, the Germans had made arrangements to blow-up the gas-works. The mines were already laid and fuses fixed, when the Manager of the Company, M. Paul Couvreur, intervened. Accompanied by a representative of the Municipality, he betook himself to the German authorities. After discussion, these authorities applied to headquarters, who telegraphed the order to spare the works "for political reasons." Wisdom a little tardy! None the less, M. Couvreur should be praised for his energetic intervention, which has spared us a disaster.

Benzol Distillation.—It is stated by the "Zeitschrift für das Berg-Hütten-und-Salinenwesen" that at a certain works in the mining district of Herne (Germany), there has been effected a shortening of the distillation process by the erection of a supplementary column on a benzol still. The installation serves for the distillation of benzol compounds to crude benzol. The column stands upon one end of the still, and is filled with porcelain balls. Its upper portion consists of two transverse coolers; and a pipe leads from the coolers to the benzol cooler. By means of steam heating pipes in the lower portion of the still, its contents are slowly raised to the boiling-point. The vapours rise into the column and ascend between the porcelain balls to the coolers. From these, the heavy products carried up fall back into the still. The light benzol vapours ascend through the funnel-shaped cover and conducting-pipe to the benzol cooler. Formerly the distillation of the contents of the still took 58 hours; whereas now, with the column, the time does not exceed 38 hours.

CORRESPONDENCE.

[We are not responsible for opinions expressed by Correspondents.]

The Gas Research Committee's Reports.

SIR,—With reference to Mr. Charles Hunt's letter which appeared in your issue of Oct. 22, I may say that in the interval between the submission by the Research Sub-Committee of its proposals for investigation into the relative efficiencies of different grades of gas and their acceptance by the Council of the Institution of Gas Engineers, Mr. Hunt approached me with a view to my making, on his behalf and that of the South Suburban Gas Company, the same kind of experimental inquiry. It was, however, plainly a matter of such importance to the gas industry as a whole that an investigation by a representative Committee which should report its results to the Institution of Gas Engineers was to be preferred. Mr. Hunt was (and is) of the same opinion—being only anxious that the work should be done; and the Committee will, I am sure, value the appreciation he expresses.

Leeds University, Oct. 30, 1918. JOHN W. COBB.

Gas-Firing of Retort-Benches.

SIR,—I notice in the "JOURNAL" of the 8th inst. a patent entitled "Horizontal or Inclined Retort-Furnaces," No. 118,804, for the formation of a duct in connection with gas producers. I should be obliged if you would allow me to state that this method of obtaining improved results from gas-firing has been in use by this Company for many years. The principles on which it is based were discussed in a paper I read before the Gas Institute in 1888.

South Metropolitan Gas Company, Old Kent Road, Oct. 31, 1918. CHARLES CARPENTER.

A United Association for the Gas Industry.

SIR,—Now that reconstruction is so much in the air, it does seem a thousand pities that the Institution of Gas Engineers does not take the bull by the horns, and propose the only scheme of reconstruction that appears likely to receive general support and prove of permanent advantage to the gas industry.

I refer to the merging of the five gas organizations—namely, the Institution of Gas Engineers, the National Gas Council, the British Commercial Gas Association, the Gas Companies' Protection Association, and the Society of British Gas Industries—into one central body, to be called (say) the British Gas Association, within which every interest might find a place, with its separate Committee and Chairman—all under the control of a thoroughly representative Committee or Council.

I cannot but think that to this complexion the industry must come, sooner or later, and why not sooner rather than later—especially in view of the very important reconstruction problems with which it is likely to be confronted at the end of the war.

The time has surely arrived for putting an end to all distracted counsels. In what better way could we commemorate the peace that is coming?

CHARLES HUNT.

17, *Victoria Street, Westminster, S.W., Nov.* 1, 1918.

The Preferable Calorific Power for Existing Appliances.

SIR,—I much regret that I was unable to attend the recent meeting of the Institution; and I should wish to be allowed to join in the congratulations to the President and Council on the success of the innovation of a special meeting, and on the epoch-making results achieved. I have reason to know that much pleasure is generally felt that eminent men of science should take part in the discussions, and give the industry the benefit of their counsel and advice.

With regard to the Gas Investigation Committee's report, I should like to express my opinion—prefacing my remarks by the statement, that what I have to say bears on the report as presented, which deals with certain applications of gas in certain appliances largely used by consumers. It may be that other appliances would give much higher efficiencies; and I agree with some of the speakers that inverted burners will probably make a much better showing with low calorific power gas than the upright pattern.

However, I am one of those who consider that the Committee have acted wisely in selecting appliances representative of those now in use on the district, and not necessarily the best or most efficient; and the results obtained so far are, undoubtedly, of immediate practical value if correctly interpreted.

In reading the discussion and the various comments on the report, one is surprised to find that the predominant impression seems to be that the report justifies low-grade gas, because of the finding that "the efficiency is practically independent of composition, inerts, or calorific value." The first impression made on my mind on perusing the report was one of disappointment at this very conclusion. I had never supposed that low-grade gas, *per se*, was more efficient than high-grade gas (except where the apparatus was better suited to the lower quality); but I had great faith in the theory that a gas of different composition, though of lower calorific power, might be much more efficient than a straight coal gas, for the reasons often stated—viz., the higher flame temperature of water gas and the smaller quantity of air required for combustion. In other words, I believed that a 500 B.Th.U. gas (made by diluting good coal gas with blue water gas) was to the consumer of as much value per foot (not per B.Th.U.) as a 540 B.Th.U. coal gas. This theoretical reasoning seems to be entirely knocked on the head by the report, and at the same time any justification for reducing the calorific power below 500 B.Th.U. gross under existing conditions, except for the period of the war.

In the "conclusions" with respect to ring-burners, the report states (the italics are mine): "As a matter of practical convenience, to deliver a sufficient number of B.Th.U. in a reasonable time *without abnormal pressures* the gas used should be of moderately high calorific value." It should be noted that in the tests each appliance was adjusted to the maximum efficiency with the particular gas tested, and that the gas consumption was varied by altering the pressure at the nipple. In order, therefore, to maintain the efficiency of existing appliances, if the quality of the gas is to be seriously reduced the pressure must be considerably increased, and every appliance must be adjusted. When it is considered that the lower quality gas will absorb more pressure in its conveyance through the mains, services, meters, house pipes, &c. (because of its higher specific gravity), and that most of the latter are too small already, I think it becomes clear that if we are to go down to 400 B.Th.U. gas we must (1) radically alter all our appliances throughout the district, and (2) distribute gas on the high-pressure system with a governor on each service.

Further objections to low-power gas would appear to be noisy burners and too large a volume of products for gas-fire flues to remove properly. This might mean neutralizing the great improvements in the construction of gas-fires brought about in recent years (silence and hygienic qualities).

What, then, are the immediate practical conclusions from this review of the subject? I submit they are as follows:

(1) That good coal gas (600 B.Th.U. gross) is too rich for the usual appliances [see report Set No. 3 Lighting Tests].

(2) That the calorific power can be reduced to 500 without upsetting the existing appliances or substantially increasing the district pressures, provided something like 25-10ths is available at the main all over the district.

(3) That in any case where a reduction in quality takes place the appliances should be adjusted, whether complaints are received or not. Consumers will usually adjust lighting burners themselves; but cooker and fire burners should also be adjusted. [I made this point at the recent meeting of the Eastern Counties Association, before the report was published.] In my humble opinion, too much stress should not be laid on absence of complaints from consumers. If the alteration be sufficiently drastic to make burners light-back, complaints will arrive. Short of this, the consumer, I believe, puts down the reduced heating power of his fire, or the increased time required to boil his kettle, to the exigencies of the war, and puts up with it for the time being. Experiment readily shows, as the report indicates, what is the effect to the consumer of too big a reduction in quality.

(4) That the Committee should be requested to make tests showing the effect on typical apparatus of reducing the quality of the gas without adjusting the appliance or altering the pressure—that is to say, imitating the conditions as they exist in many towns to-day.

(5) That the calorific power should not be reduced below 500 B.Th.U. except to meet war conditions; and in that case the pressure should be substantially increased.

(6) That efficiency, though highly important, is not the only thing to be considered. For example, a consumer may get the same efficiency from 400 B.Th.U. gas as from 500 B.Th.U. gas; but if his gas-fire gives less total heat, or his burner gives less total light, he will not be so well off.

Many will, I know, disagree with my conclusions and my statements generally; and I put them forward with some diffidence. What I am concerned about is that, without waiting for further instalments of the investigation, we should proceed to apply immediately the lessons taught by the preliminary report.

W. W. TOWNSEND.

Gas-Works, Colchester, Oct. 29, 1918.

The Distribution of Low-Grade Gas.

SIR,—In the discussion upon the report of the Gas Investigation Committee of the Institution of Gas Engineers, some of the speakers appear to have regarded as novel the discovery that the lighting efficiency of gas supplied to an incandescent burner under low pressure may be (1) as high with 350 B.Th.U. gas as with 500 B.Th.U. gas, and (2) as high with coal gas largely diluted with air as with the undiluted gas. More than fifteen years ago the late Prof. Lewes demonstrated the truth of the first fact, and Mr. Walter Grafton of the second fact. Knowledge of these facts does not necessarily involve support for the suggestion that district gas should be reduced to 300 or 350 B.Th.U., or that coal gas largely diluted with air should be distributed. Prof. Lewes's results with blue water gas, and Mr. Grafton's results with mixtures of coal gas and air can be seen in the technical publications issued in the years 1901 and 1903. It is noteworthy that Prof. Lewes obtained over 19 candles per c.ft. of water gas consumed per hour under a pressure of about 1 in. He used a form of argand burner with an ordinary "C" Welsbach mantle. The gross calorific value of the gas was, I believe, between 300 and 350 B.Th.U.

Mr. Grafton, in his paper communicated to the Gas Institute in 1901, recommended the distribution of "low-quality gas made at the works by adding a percentage of air after purification," because it would be "much more efficient and economical than pure gas of whatever quality." I do not know if any investigator has determined by experiment the effect of such a mixture upon ordinary meters.

With regard to the remarkable results which have recently been obtained by steaming in vertical and in horizontal retorts, there is no doubt that the permission to distribute gas of 450 B.Th.U. has rendered practicable economical processes which would have been useless to engineers working under the old 16-candle standard. The large increment in the quantity of tar obtained per ton of coal in high temperature retorts when working with steam, is probably due to the protective influence of undecomposed steam; for Prof. Lewes did not obtain any increase in the quantity of tar when passing blue water gas over coal during its carbonization in high-temperature retorts.

H. F. HILLS.

*The Laboratory, Gas-Works, Stepney, E.*1., *Nov.* 2, 1918.

The Research Committee's Report.

SIR,—I venture to suggest that the numerous investigators in this direction should take the trouble to search the writings and lectures of the late Mr. Thomas Fletcher, F.C.S.; and they would then find that little or no new light is thrown on the subject by the above-named report, and that practically there has been no further advancement since his days. Exhaustive experiments with all grades of gases, from undiluted oil gas to neat blue water gas, were conducted by him at various pressures.

His tests proved that, other things being equal, the actual economical results varied very little, whatever the calorific value of the gas—provided only that the burner was constructed on scientific lines and properly adjusted in the first place. On the other hand, undoubtedly, the best results were obtained when the gas pressure was only 8-10ths to 1 inch.

It will still be found that burners of his design (or the nearest imitations of them) give, even at the present day, the best working results.

When the questions of B.Th.U. and pressure are finally settled, no doubt gas apparatus makers will design something to fulfil the new conditions. But, until this is done, all investigations and experiments with burners originally designed (and often wrongly at that) to give the best results at 8-10ths pressure with 600 B.Th.U. gas are futile, and a mere waste of time. The actual burners used by the Committee itself were most unfortunately chosen, as they were entirely wrong in constructive details.

I do not suppose any of the makers are greatly concerned about what is settled finally; but I am sure they wish for the settlement soon. It would be a boon to the country, and do away with all the annoying makeshifts of gas and air adjusters, &c., which do not at present tend to popularize gas heating.

However, in the general anxiety to fix a low calorific value, it must be taken into consideration that the products will be greatly increased in proportion to the work done, and conditions would be so altered that no cooking apparatus could be safely fixed without providing special means of ventilation.

THOS. W. FLETCHER, M.I.M.E., *Chairman.*
FLETCHER, RUSSELL & CO., LTD.

Warrington, Nov. 1, 1918.

Boiling-Ring Efficiencies.

SIR,—In the interesting report of the Research Sub-Committee of the Gas Investigation Committee at the recent meeting of the Institution of Gas Engineers, there is a point which we think might be the subject of useful comment, in order to prevent otherwise probable misapprehension.

The point in question is that much higher efficiencies are shown by using the arrangement of kettle and stand illustrated in the report than those attained with the same burner used in its own position in the apparatus as supplied to the consumer. The efficiency figures shown by the Sub-Committee, using their special stand, vary from 43·2 to 58·5 p.ct. on the net calorific value. It was remarked in criticism that the consumer, using ordinary apparatus, only obtains 20 to 25 p.ct. efficiency for the gas he burns. If this represented the best results attainable, it would be a most regrettable state of things. But while we do not accept these latter figures as far as apparatus of our manufacture is concerned, our present purpose is not to enter into discussion of them. What we desire is to state that, as manufacturers, we are satisfied that the last and best word has not yet been said in this matter of efficiency. For our own part, the question has, naturally, received much attention at the hands of our technical staff; and when the cessation of the war allows us to resume our ordinary business, we shall be prepared to supply apparatus which, under ordinary consumers' conditions, will give efficiencies of higher average than even those of the report, with the special arrangement it describes.

JOHN WRIGHT & CO.

Essex Works, Aston, Birmingham,
Oct. 31, 1918.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

Progress of Bills.

On Monday of last week, the Chairman of Committees informed the House that the opposition to the South Suburban Gas Bill had been withdrawn. The Bill was committed.

The South Metropolitan Gas Bill was reported with amendments.

The Gas Light and Coke Company's Bill was brought from the Commons, read the first time, and referred to the Examiners.

The Commercial Gas Bill and the Portsea Island Gas Bill were read a second time, and committed.

HOUSE OF COMMONS.

Progress of Bills.

The Gas Light and Coke Company's Bill was read the third time, and passed.

Electricity Charges.

Sir G. GREENWOOD asked the President of the Board of Trade whether his attention had been called to the prices per unit of electricity now being charged by certain electric lighting companies in the Metropolis; whether there was any limit for such prices analogous to that imposed by Statute in the case of gas companies; and, if not, whether he would consider the desirability of taking steps in order that such limit might be imposed.

Sir A. STANLEY, in reply, said that the Statutes under which the undertakings of electric lighting companies in the Metropolis were authorized in all cases fixed a maximum price which might be charged. Their position was therefore analogous to that of gas companies having a maximum price.

Increased Supply of Matches.

Mr. SOMERVELL asked the President of the Board of Trade if, with a view to economy in domestic gas consumption, he would take steps to increase the supply of matches.

Mr. PARKER, who replied, said that arrangements had already been made by the Board of Trade for the importation of a supply of matches, which would very materially increase the number available for use by the civil population.

Lighting Restrictions.

Major NEWMAN asked the President of the Board of Trade whether he was aware of the darkness in which the northern suburbs of London were at present plunged owing to the necessity of economy of fuel on the part of the local authorities, the shading of what weak lights were shown as a precaution against enemy aircraft, and the utilization of a good part of the lighting and fuel available by newly-erected factories engaged on urgent war work, and whether he could hold out any hopes of an early improvement in suburban conditions of lighting.

Mr. WARDLE (the Parliamentary Secretary to the Board of Trade), who replied, said he would see whether anything could be done in the matter; but it was not an easy one.

Coal Miners and Coal Shortage.

Major H. TERRELL asked the President of the Board of Trade whether he was aware that the coal shortage was not wholly or mainly due to absenteeism on the part of colliers, and whether, if colliers worked five days a week, nine hours per day from bank to bank, and there were no absenteeism or strikes, the supply of coal would be sufficient for all requirements.

Mr. WARDLE, who replied, said he was aware that the coal shortage was not wholly or mainly due to absenteeism, although a decrease in avoidable absenteeism would largely mitigate it. He did not anticipate that any material increase in the output of coal would result from an endeavour to arrange a working week of five days of nine hours each from bank to bank. If there were no avoidable absenteeism or strikes, a considerable part of the shortage would be made up.

Major TERRELL asked whether, in collieries and underground, workmen were not permitted to work more than eight hours from bank to bank, and whether, on an average, an eight-hour day from bank to bank meant less than seven hours' actual work.

Mr. WARDLE replied that section 1, sub-section 1, of the Coal Mines Regulation Act, 1908, enacted that, subject to the provisions of the Act, a workman should not be below ground in a mine for the purpose of his work, and of going to and from his work, for more than eight hours during any twenty-four consecutive hours. As some time must be expended in going to and from work, the actual period of work at the coal face might be, and often was, considerably less than eight hours.

Action against Gas Light and Coke Company.

On the 29th ult., Mr. Justice Peterson, in the Chancery Division of the High Court of Justice, gave judgment in the action of *Levet v. Gas Light and Coke Company*, the trial of which had occupied several days. Plaintiff, who carries on business as a wood turner in a narrow passage called Laundry Yard, Horseferry Road, Westminster, claimed an injunction restraining defendants from interfering with the access of light to his premises, and damages for past injury. The interference was alleged to have been caused by defendants erecting a bridge across the yard connecting their adjoining premises. It was alleged that some windows and doorways had been darkened by the erection. His Lordship (who had viewed the premises) said that, as the result of his inspection, and the evidence which had been given, he had come to the conclusion that the only window which had been interfered with was that in a closet; and for such interference he thought £15 would be adequate compensation. As to whether light to the doorways had been interfered with, this was the first case in which it had been contended there was a prescriptive right to light to a doorway where at one time the door was open and at another time closed; and to accede to plaintiff's contention would lead to surprising results. The plaintiff's contention, that he had acquired a right to light to the doorways, could not be supported. There would be judgment for plaintiff for £15, and each side must pay its own costs.

Price of Gas at Spenborough.—The Spenborough District Council have decided to increase the price of gas to power and ordinary lighting consumers 10d. per 1000 c.ft., discounts remaining as before. The total rise during the war has been 1s. 4½d. per 1000 c.ft.

Coal Shortage at Edinburgh Gas-Works.—At a meeting of the Works Committee of the Edinburgh and Leith Gas Commissioners on the 14th ult., there was submitted a letter from the Engineer (Mr. Alexander Masterton) with regard to a shortage of coal at the works. Mr. Masterton stated that the make of gas per ton of coal during September had fallen to 10,058 c.ft., and that it had since dropped still further. The decreased make was due partly to the shortage of deliveries necessitating the lifting of coal from stock—some of which had been stacked for about twelve years—and partly to the inferior quality of some of the coal allocated by the Controller. Mr. Masterton had made repeated representations to the Controller, but without any improvement, though he had received an assurance from him that he was keeping the case prominently before him, and would help as much as possible. The stock of coal, which a year ago was 52,000 tons, was now only 15,000 tons, or equal to between two and three weeks' requirements during the maximum consumption. If it should be necessary to continue to lift coal from stock, at the present rate of 1000 tons a week, and keeping in view the cessation of work by miners during the New Year holidays, the stock would be entirely exhausted by the middle of January.

MISCELLANEOUS NEWS.

THE GAS COMPANIES' PROTECTION ASSOCIATION.

The Twenty-First Annual General Meeting of the Association was held last Thursday, at the Central Hall, Westminster, S.W. Mr. H. E. JONES, the Chairman of the Committee, presided.

The following attendances were noted in the register: H. E. Jones (Chairman), W. Belton (Shrewsbury), W. F. Whittaker (Grays and Tilbury), Alex. A. Johnston (Brentford), T. H. Hazell (Newport, Mon.), Geo. Clarry (Cardiff), Geo. Andrews (Swansea), Hanbury Thomas (Sheffield), W. A. Scott (Ascot), H. C. Head (Winchester), R. Bruce Anderson (City of Waterford), Charles Carpenter (South Metropolitan), S. Y. Shoubridge (South Suburban), D. H. Helps (Reading), C. F. Botley (Hastings), D. Milne Watson (Gas Light and Coke Company), and J. R. H. Jacobs (Southampton).

The SECRETARY (Mr. F. E. Cooper) read the minutes of the last meeting; and they were confirmed.

It was mentioned that letters of regret had been received from Messrs. Ferguson Bell, Bloor, Edwards, Hall, and Stibbs.

ANNUAL REPORT AND ACCOUNTS.

On the suggestion of Mr. W. BELTON, the annual report and accounts were taken as read. The report was as follows:

The Committee herewith present the revenue account and balance-sheet, together with a report of the proceedings of the Association for the year ended Sept. 30, 1918.

The ascertained expenditure amounted to £548 19s. 2d. The revenue was: Subscriptions and donations, £550 6s. 1d.; income-tax refunded, £29 9s. 5d.; interest on War Loan, £198 2s. 9d.—amounting together to £777 18s. 3d., being a surplus of £228 19s. 1d., from which, however, must be deducted the costs incurred by the Association, as hereafter mentioned, in appearing before the Select Committee of the House of Commons on Gas Undertakings (Statutory Prices), which amount is not yet ascertained. From the balance-sheet, it is seen that the assets amounted to £4719 1s. 8d., consisting of £4636 10s. 5d. of 5 p.ct. War Loan, 1929-1947, at cost, £4404 14s. 5d., and balance at bank and cash in hand £314 7s. 3d. From this total must be deducted the amount owing to the bankers—viz., £2925; leaving a balance in favour of the Association of £1794 1s. 8d., subject to the payment of the costs above referred to.

The Committee gave careful consideration to the growing hardship experienced by gas undertakings arising from the abnormal price of coal, materials, and labour, and its effect on gas charges and dividends, and decided that action could not be taken by a General Bill promoted by the Association. The Committee considered how they could best serve the interests of gas companies in connection with the proceedings before the Select Committee of the House of Commons above referred to; and, after anxious consideration, it was decided that they should appear before the Committee on the question of the procedure to be recommended by future applicants for relief. In accordance with this decision, the Committee duly appeared before the Select Committee by Counsel.

When the report of the Select Committee was issued, it was at once realized that the relief which the Select Committee recommended should be given to gas companies was most inadequate; and the Committee at once took every possible step to obtain better terms. They attended a deputation to the President of the Board of Trade upon the matter, and prepared and sent to the President a reasoned statement setting forth the objections to the proposals. The President, however, felt that the Board of Trade could not depart from the recommendations of the Select Committee; and it therefore only remained for the Committee to endeavour to secure better terms from Parliament itself. With this object in view, when the Government Bill giving effect to the Select Committee's recommendations was introduced into Parliament, they had a statement prepared setting out the objections to the proposals, which was forwarded to all members of the House of Commons. Other steps were also taken to get the Bill altered, and ultimately the House of Commons decided that relief should be given so as to enable a company to pay three-quarters of its maximum standard or pre-war rate of dividend, whichever was the lower, instead of one-half as proposed by the Bill.

On its introduction into the House of Lords a proposal was made to reduce the three-quarters to one-half. The Committee prepared and circulated among the members of the House a statement against the proposal, and in support of the Bill as it left the House of Commons. Ultimately the Bill passed the Lords in that form, and it was duly passed into law.

The Committee are of opinion that the relief afforded by the Act is inadequate; but they are convinced that, although they were not successful in obtaining completely satisfactory terms, the course they took with reference to it was largely instrumental in obtaining the alteration referred to.

The Committee have had under consideration the claim made by the Board of Inland Revenue to payment of loan capital duty on bank loans and overdrafts. They are of opinion that the duty is not payable, and are in correspondence with the Board upon the matter. At the present time it can only be said that the Board still persist in their claim; and as it is a matter of serious importance to gas companies generally, a test case may have to be fought out in the Law Courts.

The Committee have appointed a Special Sub-Committee to consider (*a*) the constitution of the Association, (*b*) the objects of the Association, and (*c*) the relations of the Association with and to other bodies, and generally such provisions as may be deemed desirable for adoption to bring the Association into line with the present and anticipated future requirements of the gas industry, particularly as affecting statutory and non-statutory undertakings owned by companies. The Sub-Committee are now engaged in considering the matters referred to them, and will in due course report to the Committee on the result of their deliberations. In the event of the Committee being of opinion, when they have received the Sub-Committee's report, that any change in the constitution and objects of the Association is desirable, a special general meeting of the Association will be convened to consider the matter.

The following are the principal matters upon which the Secretary has been consulted during the year under review:

Sale of light oils from tar. Application of insurance fund to abnormal cost of coal, &c. Increasing price of gas during current quarter. Payment of duty on transfer of limited company to statutory company. Coal gas for motor transport. Price of gas—unfulfilled coal contract. Increase of meter rents. Gas Bills to ameliorate financial hardships. Increase by company of contract price of coke. Agreement for the supply of gas in bulk. Bonus to certain classes of semi-skilled and unskilled workers. Charges for coke. Point on Coal (Pit's Mouth Prices) Order, 1917. Coal transport reorganization—coal charges. Coal exports from United Kingdom for gas making. Wages of women-workers at gas-works. County Council protective clauses in Gas Bill. Supply of gas for use outside limits. Consumers' liability for meter destroyed by fire. Payment by company of income-tax on director's fees and officials' salaries. Notice to consumers of increased price of gas. Increase in directorate. Inland revenue claim to duty on bank overdraft. Applicability of local by-laws to gas company's buildings. Laying gas pipe in private road. Difficulties in obtaining supplies of coal. Rent for slot meters. Disposal of effluent from gas-works.

The total number of members of the Association is 136.

The following members retire from the Committee in accordance with Rule 9: Mr. George Andrews, Mr. George Clarry, Mr. R. W. Edwards, Mr. T. H. Hazell, Mr. D. H. Helps, and Mr. Thomas Waddom, all of whom offer themselves for re-election, with the exception of Mr. Waddom.

A REVIEW OF THE ACCOUNTS.

The CHAIRMAN, in moving that the report and accounts be received and adopted, said, running through the accounts first, it would be seen that, in their modest way, they had received an income of £550, including £65 2s. arrears, and a new member £1 11s. 6d. Their Secretary had been clever enough to do what very few men were able to do—get income-tax refunded to the amount of £29 9s. 5d. Income by way of interest derived from the 5 p.ct. War Loan was £198 2s. 9d., which extinguished a charge of £147 for interest on the loan from the National Bank, and gave a margin of £51; so on that transaction they were all right financially. The total receipts amounted to £777 18s. 3d. The expenditure, which included a contribution of £100 to the funds of the National Gas Council, and the £147 interest on loan already referred to—amounted to £548 19s. 2d. The surplus for the year carried to the balance-sheet was therefore £228 19s. 1d. This balance he was bound to tell them was partly compromised to the extent of £100 for a contribution to the costs incurred by Mr. W. A. Scott in appearing before the Committee who investigated the question of financial relief for gas companies on behalf of small companies not otherwise represented before the Committee. There were also the Association's own costs of watching and taking part in the proceedings before the Committee. The last-mentioned costs had not yet been rendered or certified; so they must not consider that for the past year of stress and difficulty, trouble and anxiety, they had quite struck the balance.

THE FIGHT FOR FINANCIAL RELIEF.

With regard to the proceedings before the Committee who considered the question of financial relief, some of their smaller members wished to put their case before the Committee; and it would have been a heavy burden to have thrown the cost of doing this on those who expressed the desire. It might be said that the companies were small. They were small; but they showed that not only did the state of things created by the war affect the profits of the large companies who had been for years under the sliding-scale (and had done very well by being under it), but that it had reached the companies having maximum prices and dividends, and companies who had hardly (so to speak) got established on their feet, and so were suffering worse than would otherwise have been the case had it not been for the war's privations. He should not like anyone to think the sliding-scale had failed. It was the war that had failed all of them. He was a Director of two companies who were not paying any dividend whatever, and had not done so for the last three years. As an instance of what war difficulties had reduced them to in a great place like Buenos Ayres, he might say they were now making gas out of bran, damaged corn, and other things which were ordinarily very costly. However, this by the way. They must look for any failure of the sliding-scale to meet war conditions as coming from Parliament, when the endeavour was made to reduce the burden inflicted upon gas companies by the war. The modicum of relief given could scarcely have been much less. For some time Parliament, through the report of the Select Committee, contemplated giving the companies only half their standard or maximum dividend. He could not help thinking that what was really in mind was half the dividends paid before the war; but the report put it plainly as half the standard or maximum dividend. However, the Rt. Hon. Sir Daniel F. Goddard, Mr. Reginald Neville-Neville, and Sir Fortescue Flannery (their President) managed to squeeze out 50 p.ct. more, and so got three-quarters instead of half of the standard or maximum dividend. Seeing that the recommendation of the Committee did secure to the companies their debenture interest and preference share dividends, for the small mercy gained above the recommended half of the standard or maximum dividend, they must be thankful. He did not think they would have obtained this as they did had it not been for the admirable statement which Mr. Cooper—their Secretary's brother—prepared for them, and which was sent to the members of the House of Commons, and later, he (the Chairman) undertook this should be done, to the members of the House of Lords as well. It stated, in concise and cogent, and perfectly respectful, terms, the extreme hardship of the position of the companies; also that they had furnished everything the war departments wanted, and at regulated prices, so that there had been no profiteering, and attempting to get their own again. As a matter of fact, by the time they had in some works paid the price of altering their plant to produce what was required, they found themselves altogether on the wrong side of the balance-sheet. Though the Association did this work of informing members of Parliament, it in no way invalidated the efforts of any of the other authorities. Certain members of Parliament had told him that, until they got the informative memorandum, they did not at all understand the position. While the House of Lords was never inveterately prejudiced, he did think that in the House of Commons there was a sort of prejudice against gas companies and public utility undertakings generally. Just before the present meeting, he came from a table at which sat with him an influential man in the electrical industry; and his bitterest complaint was the way in which public utility undertakings generally had been used by Parliament and by local authorities, especially during the time of war. He (the Chairman) was rejoiced to hear that the experience was not solely that of gas companies, but of others as well. He thought he might say the Association in this matter of financial relief made the very best of a bad position. They were advised, and quite

properly, that it was impossible, no matter how soon they had begun—even had it been a year before—for the Association to have promoted a Bill to give relief far and wide. Nobody else had done, or could have done, more. It was absolutely necessary that the undertakings concerned—no matter whether as large as the Gas Light and Coke Company represented by Mr. Milne Watson, or as small as the undertakings represented by Mr. Scott—should have their cases considered individually. The impression was abroad that the Association had not done all they should have done. It was not possible to do more.

DUTY ON BANKERS' LOANS.

Then he came to the claim by the Board of Inland Revenue to payment of loan capital duty on bank loans and overdrafts. He did not think they would have much difficulty about this. Two companies with which he was connected, with a considerable amount of borrowed money, were asked as to their loans; but when the Inland Revenue people found they were bankers' loans, they dropped the matter. A circular had gone out inviting answers to certain inquiries, so as to strengthen the Secretary's hands in any action that might ultimately have to be taken.

THE CONSTITUTION OF THE ASSOCIATION.

A Special Sub-Committee were inquiring into the constitution of the Association. Personally, he did not think there was much the matter with it. He had been in the chair for many years, to which his election was secured by Sir George Livesey. It was true the Association was modest; and the amount of money with which they were entrusted had been spent about as well as any contribution to possibly any other Association of a voluntary character. But the Sub-Committee had not yet reported. When it did the Committee would give their best attention to their representations.

INFORMATION REQUIRED.

Then there was a long list of matters in the report which members would not ask him to go through. It consisted of inquiries made to the Secretary; and it showed that the smaller companies who had not the same accumulated experience as the larger ones had applied to the Secretary for hints and information upon a large number of useful points in the administration and functions of gas undertakings. One of the greatest uses of the Association was to help the smaller companies. Something like thirty-two subjects had been dealt with by the Secretary; and if he had charged the usual professional fee, he would have considerably overlapped the modest sum they paid him for his services.

INCREASE IN THE MEMBERSHIP.

The total number of members of the Association was 136 at the end of the year to which the report referred, and 11 had come in since; so that they had now 147. Concluding his remarks, the Chairman referred to the re-elections of members of the Committee, excepting Mr. T. Waddom, who has retired. There was also a vacancy on the Committee in consequence of the death of Mr. Thomas May.

Mr. HANBURY THOMAS (Sheffield), in seconding the motion, said in regard to the payment of duty on bankers' loans, he was glad to hear there was a prospect of the authorities not being successful in this direction.

SUGGESTIVE CRITICISM.

Mr. H. C. HEAD (Winchester) remarked that there was no time in the history of gas companies when a strong Gas Companies' Protection Association was more necessary than the present; and he did hope that everything would be done to strengthen the Association, and not to weaken it. At the end of the report, the Committee stated that there were 136—and the Chairman told them the number had since been raised to 147—companies belonging to the Association. He had not in mind the total number of gas companies in the Kingdom. But the number must be a large one—well over 500; and he should like to see the number enrolled as members 436 instead of 136. He hoped every effort would be made to secure that the Association did in reality speak for the majority of the gas companies of the United Kingdom. He felt sure that, if the services of the district gas organizations were obtained, they would do everything they could to help the Association. This, of course, was merely a personal opinion. With regard to the report, might he suggest to the Committee who were considering the matter of constitution, that the title of the Gas Companies' Protection Association, although absolutely describing what the Association set out to be, and what it was doing, was rather an unfortunate one with which to go forward to the public. "Association of Gas Companies" might ensure much more confidence from the public than "Gas Companies' Protection Association," which gave one the idea very strongly that it was out to push the interests of gas companies against all-comers, rather than to push the interests of gas companies as representing both consumers and shareholders. His next point was as to the list of matters on which the Association had been consulted. It was a very suggestive list. But there was no information attached to it at all; and he felt sure the Boards of the various gas companies who subscribed to the Association would welcome a more lengthy report of these various matters on which the Secretary had been consulted. In his opinion, too, it would strengthen the position of the Association, as it would bring home to the Board of Directors the good work the Association were doing. As it stood at the moment, the report was not very convincing. There was one other point to which he should like to draw the attention of the Committee. It was that, among the smaller companies who subscribed, there was a certain amount of diffidence in submitting matters to the Association. This diffidence ought to be broken down in the interests of all concerned; and he did hope that steps would be taken to bring home to the smaller undertakings who subscribed that the Association welcomed inquiries; and that they would receive sympathetic consideration, whatever might be their nature.

The CHAIRMAN, in reply, said as to printing the answers sent to inquiries, this would enable the information (which should be confined to members of the Association) to be read in the public Press by others who were not subscribers. It might also provoke correspondence with small companies who were outside the Association. Their poor Secretary would be overwhelmed by it all. The Committee had several times thought over whether it would be enlightening and entertaining to the members to see the kind of answers sent to the inquiries. But the conclusion was that they ought not to give the whole information away through the pages of the Technical Press.

Mr. HEAD: I did not suggest you should do so, but that your report should be amplified.

The CHAIRMAN (continuing) said the report was usually published in the "GAS JOURNAL" and other papers; and he thought it would be an invidious thing to cut out any part of it. With regard to the usefulness of the Association, it was quite true the number of undertakings was only 147. But circulars were sent out some years ago to a long list of other concerns; and with many the Secretary had corresponded direct. If the importance of the 147 was considered, it would be found that the number comprehended all the gas companies in the Kingdom above a certain standard. Some of the 620 companies in existence were not even statutory ones. Some of them were selling very small quantities of gas in villages. But even these he did not wish to ignore; and the wisest thing these undertakings could do would be to pay their sovereigns, and join the Association. It was to get in these small concerns that some time ago he induced the Committee to lower the scale of fees which had been in existence up to that period. But they could not make horses drink by taking them to the water, or even by taking the water to them. The Committee would welcome any action taken by the District Associations to get more members for the Association. They had had members on the Committee who were connected with District Associations; but this had not assisted them in getting hold of the undertakings that remained outside. Perhaps Mr. Head himself would like to come on to the Committee, and work out the problem as to how this should be accomplished. As to the title of the Association, it was given to the Association by men of great experience, who took care of the interests of gas shareholders. The Association was there simply to protect as far as possible through legislation. They had to refer to history to find out what the Association had done. In connection with the sulphur restrictions, the Carpenter burner, and many other important things the leading companies had through the Association fought not only for themselves, but for the smaller companies. The Association had done great work. They had a great pioneer in Sir George Livesey. Whenever he saw a wrong, an injury, or a shackle, he wanted to remove it. Their work had been to protect from legislation of a restrictive or a punitive character. In doing this, they secured equal immunity for the smaller undertakings. When they got before a Committee of Parliament, it was very useful to be a defensive and not an offensive body. The gas industry did not get much sympathy from Parliament; but when Parliament saw they were simply protecting their rights they were more likely to be willing to listen to them than if they were merely a combatant body. The Association had done its duty right manfully and well.

RE-ELECTIONS OF MEMBERS OF COMMITTEE.

On the motion of the CHAIRMAN, seconded by Mr. C. F. BOTLEY, the retiring members of the Committee (except Mr. T. Waddom, who has resigned) were re-elected.

NEW BLOOD.

There were two vacancies to fill—through Mr. Waddom's resignation and the death of Mr. Thomas May.

Mr. HEAD asked whether Mr. Hallewell, the General Manager of the Bristol Gas Company, had been asked to join the Committee.

The SECRETARY replied that the Company were not members of the Association. The Committee passed a resolution that if the Company would join, the new Engineer (Mr. R. Robertson) should be asked to become a member of the Committee.

The CHAIRMAN remarked that Mr. Head had raised a very important point. The Association should be well represented in that distant part of the country. He thought they ought to make another effort to get the Bristol Company in.

On the motion of Mr. HEAD, seconded by Mr. CLARRY, it was resolved that the Bristol Gas Company should be again approached with the view to joining the Association, and to Mr. Hallewell becoming a member of the Committee.

The CHAIRMAN remarked that there was another vacancy to be dealt with, due to the death of Mr. May. He had had a letter from Mr. Scott (who is one of the Auditors) stating that he did not wish to push himself forward, but, as he had been connected for many years with the gas industry, and especially with the management of some of the smaller companies, if he could be of any assistance on the Committee, he would be pleased to serve. Then they would want another Auditor.

Mr. BOTLEY pointed out that the Association were not well represented in the North of England. It would be unfortunate if the Committee became entirely a London and Southern one.

The SECRETARY said that two members of the Committee suggested that Mr. Ridley, of Newcastle, should be asked to join the Committee. He (Mr. Cooper) wrote to him; and his reply was that, as his Company contemplated retiring from the Association in December next, he could not see the utility of serving on the Committee.

On the proposition of Mr. HANBURY THOMAS, seconded by Mr. CLARRY, it was proposed that Mr. Wade Deacon, of Liverpool, or someone nominated by him, should be asked to serve.

REAPPOINTMENT OF AUDITORS.

Moved by Mr. WHITTAKER, and seconded by Mr. HEAD, the Auditors (Messrs. W. A. Scott and Mr. S. Y. Shoubridge) were reappointed.

STRENGTHENING THE ASSOCIATION.

Mr. D. H. HELPS (Reading), before the meeting terminated, expressed the hope that every effort would be made to strengthen the Association. It was the only organization in existence for protecting the interests of gas companies; and this was a point that should be made in trying to secure new members. The National Gas Council did great work; but it embodied both companies and municipalities. The Association had done magnificent work in looking after the interests of the shareholders of gas companies; and therefore everything

should be done that could be done to strengthen it. He hoped they would get new members, and not lose any.

Vote of Thanks.

On the motion of Mr. Scott, seconded by Mr. Head, the Chairman and the Committee were heartily thanked for their services.

SULPHATE OF AMMONIA ASSOCIATION.

The Committee's Fourth Annual Report.

In view of the annual general meeting of the Sulphate of Ammonia Association last Thursday, the Committee issued a lengthy report, from which the following passages are extracted.

The work of the Association has been fully maintained and extended during the year under review.

Under the arrangements by which all sales of sulphate of ammonia for export and for munitions purposes were placed in the Association's hands, a quantity of 49,419 tons was sold, and a total surplus of about £76,400 was realized and distributed in accordance with the terms of the equalization scheme—this sum representing £70,100 on 27,600 tons delivered for export, and £6300 on 21,800 tons for munitions.

No difficulty of any kind was met with in dealing with these comparatively large quantities through a central office; and it will interest members to know that we were able to finance the entire transactions out of the small balance carried forward at the end of each period after paying dividends under the equalization scheme.

For the coming year the Ministry of Munitions has decided to place all industrial sales in the hands of the Association; and the surplus will be pooled among all makers in proportion to their production.

It fell to the Makers Sub-Committee of the Sulphate of Ammonia Distribution Committee to conduct the negotiations with the Ministry of Munitions and the Food Production Department in order to obtain an advance in the fixed price for the season 1918-19. The Association was able to collect, for the information of the Committee, a large mass of evidence regarding the cost of production, which will remain of permanent value. An increase of £2 7s. 6d. per ton on the 1917 price was secured, together with guarantees against any further increase in the cost of acid and bags.

The subsequent decision of the War Cabinet to maintain prices at the 1917 level to the farmer—involving as it does a heavy contribution from the taxpayer—came as a surprise to makers. There is little doubt that farmers could and would have paid a much higher price for sulphate if not for superphosphate. But in war time no risks in regard to food production should be taken; and the Association cannot quarrel with a decision which gives sulphate a valuable advertisement.

Throughout last year the Association was employed by the Food Production Department in arranging the distribution of sulphate of ammonia for agricultural purposes. Up to the end of September, 1917, makers had more or less a free hand as regards home sales. But from October onwards the Association took practical control; and agricultural orders for about 130,000 tons were placed with makers. The total deliveries for home agriculture was 238,000 tons. The comparative figures for the previous seasons were 150,000 and 62,000 tons respectively.

The fact that the stocks in May, 1917, were 10,500 tons, whereas the quantity at the works in May, 1918, was only 7600 tons (in spite of a largely increased capacity for production at the later date) is an eloquent testimony to the patriotic spirit in which makers assisted the Association, although during the last two months, at any rate, it was not to their financial interest to do so. The officials of the Food Production Department have on several occasions expressed their sense of obligation to makers and to the Association for the results achieved.

For the coming year, the provisions of the Fertilizers Prices Order, 1918, govern all transactions in sulphate of ammonia for home use. The main object of the Order is to secure the most economical distribution possible, as far as freight and use of trucks are concerned; and the almost complete control which it gives to the distributing body should serve to secure this object. In view of the experience gained last year, however, the extension of bureaucratic control over sulphate of ammonia is a matter for some regret.

It was necessary that the work in connection with distribution under the Order should be done in an official manner; and the Committee, therefore, agreed to the acceptance by the Manager of the position of Joint Secretary of the official Fertilizers Allocation Committee, set up by the Boards of Agriculture for England, Scotland, and Ireland. This Committee controls the distribution of the entire production of sulphate of ammonia, basic slag, superphosphate, and potash.

It has been the policy of the Association ever since 1915 to get into touch as far as possible with the regular distributors—such as country corn and manure merchants; and the result of the experience gained during the past seasons has been to acquaint us with all the agricultural merchant buyers throughout the country. And the fact that we were able to book orders prevented export brokers from obtaining a species of vested interest in the home market, such as they undoubtedly held in the export market. This knowledge should prove a valuable asset for the future, as it is clear that the home market is likely to remain our chief outlet. The efforts required to maintain our position at home will, of course, depend on the amount of competition experienced from other forms of nitrogen. Should this competition prove very severe, it may be necessary to devise other methods of distribution. In the meantime, the Committee are convinced that every effort must be made to retain the interest of the country merchants by giving them reasonable security as regards market fluctuations, and by putting them on as favourable a basis as regards trading as they enjoy from our competitors. It is also of vital importance for the quality and mechanical condition of sulphate of ammonia to be so improved as to compare favourably with the condition of nitrolim and nitrate of soda.

Under the Fertilizer Prices Order the maker of sulphate of ammonia containing less than 0·025 p.ct. of free acid is entitled to charge 5s. per ton extra. This official recognition of the value of better quality has resulted in further experiments being made with a view to producing neutral salt.

The Association issued a circular giving full particulars of the "Adam Process" now in operation at the works of the Gas Light and Coke Company. The salt produced is superior to any sulphate of ammonia previously placed on the market in Europe; and it is to be hoped that the great majority of makers in the country will be producing neutral sulphate by the time export on a large scale is again possible. The question of quality is, however, equally important as a means of retaining the home market; and in this connection a remark at the end of the final judges' report of the competition is illuminating: "In the course of our visits to the competitors, two points have specially struck us—firstly, the universal praise bestowed upon the salt supplied by the South Metropolitan Gas Company, and, secondly, the good quality and uniform appearance of the bags which are being supplied this year."

The sulphate produced by the South Metropolitan Gas Company was the nearest approach to neutral salt available at the time; and it is interesting to note that the Company have expressed their intention still further to improve the make with a view to eliminating the free acid altogether.

As regards bags, the Association purchased from the Government for a very large number of makers several million new twill bags capable of containing 2 cwt. each. It seems desirable for this arrangement to be continued after the period of control, in order to ensure that the sulphate may be sent out in suitable bags.

We close this report, we hope, with the end of the war in sight; and our next report may deal with after-war problems. We venture to hope that the lessons learnt, and the experience gained, by the Association and its members will be utilized to the full in dealing with these problems. Uniformity and stability of price, improvement in quality and packing, and scientific distribution—these are a few of the chief factors which have led to the enormous expansion in our home trade during the war. If we are to retain this most valuable market at our doors, means must be devised to ensure the continuance of such a scheme of distribution on national lines.

A proposal, therefore, will shortly come before members for consideration as to the formation of a Sulphate of Ammonia Trading Company, to be owned and controlled entirely by makers of sulphate of ammonia. Its object would be to relieve the individual maker of the responsibilities and risks of seeking his own market, while at the same time guaranteeing to him the market price, both at home and abroad, and free disposal of his production. It is felt that such a Company, if supported by the large majority of makers, would be in a position to take the necessary steps to retain and expand the Home market, and to take the fullest possible advantage of the opportunities afforded by the export market.

The Chairman (Mr. D. Milne Watson), in the course of his speech, in moving the adoption of the report, said: During the past year the work of the Association has been fully maintained and extended; and I think you will agree that the results obtained through the export equalization scheme have been satisfactory—makers having received £76,400, in addition to the full agricultural price. The first dividend for the present year under the scheme has just been paid; and you will, no doubt, be gratified to find that while during the same period of last year, the 14,000 tons dealt with yielded a surplus of £44,000, this year a profit of £35,000 has been obtained on 7800 tons, in spite of the fact that we have had to pay the Ministry of Munitions a very large sum in accordance with the arrangement of June 6 last. I remember that some doubts were expressed as to the feasibility of such a scheme, when the plan was first mooted. But the results obtained seem to have placated our critics; and this, in itself, I consider sufficient reward and justification to the authors of the scheme for their labours. While we have thus been fully occupied with the actualities of the present, the report shows that we have not lost sight of the potentialities of the future. Owing to good fortune and hard work, we are now in the happy position of having a large market at our doors, which I believe to be capable of still greater expansion. Sulphate of ammonia has at last found its way into the heart of the land, throughout the length and breadth of these islands. Our watchword for the future should be "Keep it There." To this end, three things are essential: Good selling organization, good quality, and good propaganda. The report shows how we are endeavouring to strengthen the effectiveness of our propaganda; and as to quality, I am afraid that those of you who are good enough to attend these meetings regularly will be ready to receive my annual sermon on so well-worn a theme. The question of quality is all-important. To give you one fresh illustration. We are at present using 238,000 tons of sulphate on the land; and the quantity of nitrate used here for agricultural purposes before the war probably did not exceed 80,000 tons. And yet I have recently seen the price lists of some of the chief makers of mechanical fertilizer distributors or "drills;" and there is no mention of sulphate of ammonia. There are elaborate gearing tables worked out for nitrate, for kainit, for superphosphate, and for basic slag, but not for sulphate. And why not? The invariable answer is that the bulk of the sulphate still produced in this country cannot be put through a mechanical distributor because it is too lumpy and too wet. For a remedy for this state of affairs, I again refer you to the report, which shows that in this respect also we have not been idle. An appeal to the Committee to state what they are doing with regard to post-war problems has recently appeared in the "Gas Journal;" and the menace of competition from British synthetic production has been alluded to. I understand that no results on a commercial scale are to be expected from synthetic sulphate of ammonia processes in this country for some time; but this fact should not induce us to under-

estimate the possibilities in this direction, nor to refrain from taking the necessary steps to meet such competition in the future. This brings me to the question of a selling organization. It seems to me quite obvious that sulphate of ammonia cannot hope to compete successfully with other forms of nitrogen unless it can present a united front to such competition; and I think events are showing that the degree of solidarity among makers represented by the selling branch of the Association at its inception cannot be regarded as sufficiently strong for the future. It is for this reason that the suggested alterations in the rules consequent on last year's resolution to amalgamate the Committees, have not yet been submitted to you. The proposals with regard to the future of the Association—mentioned in the report, which will shortly come before you for consideration—will however suggest a solution for these difficulties. Whether or not these particular proposals commend themselves to the majority of makers, I feel sure that the lessons which the war has taught us, and the experience gained, will be of immense help to guide us in dealing with the problems which the future has in store for us.

METROPOLITAN GAS COMPANY OF MELBOURNE.

Half-Yearly Meeting.

The Eighty-First Half-Yearly Meeting of the Company was held on July 27, at the Offices in Melbourne—Sir JOHN GRICE (the Chairman) presiding.

The MANAGER and SECRETARY (Mr. John Hinde) read the notice convening the meeting; and the report and accounts for the six months ended June 30 were taken as read.

The CHAIRMAN said that 40 employees had now made the supreme sacrifice in the Empire's cause, out of a total of 328 who left Australia for the war. The allowances to employees on active service amounted during the half year to £3465. The quantity of gas sold in the six months was 1659 million c.ft., as against 1593 millions for the corresponding period of last year—an increase of 4·15 p.ct. The repeal of the Daylight Saving Act was responsible for nearly the whole of this gain. The number of meters in use at June 30 was 154,725, as compared with 152,139 at the corresponding date of last year—an increase of 1·69 p.ct. The total number of stoves sold during the half year on hire-purchase and outright was 3406. The number in use at June 30 showed an increase of 5735 over the corresponding date of last year. Sales of gas-fires showed a decrease; 1630 being fixed, as compared with 1926. During the six months, 4 miles of mains and 35 miles of services were laid. The work of reconstructing the gasholder at West Melbourne would probably be completed next month. The capacity of this holder was being increased by about 50 p.ct.—up to 1½ millions. It was expected that the erection of the holder at the Fitzroy works would be shortly commenced. It would be necessary at an early date to erect a large holder in the northern suburbs. The second Woodall-Duckham carbonizing plant would shortly be at work; but the difficulty of obtaining timber piles for foundations had retarded the commencement of the erection of the third installation on this system at West Melbourne. As regarded the price charged for gas, this Company used to be told that their rate was excessive, by reason of that in Sydney being considerably lower. A Supreme Court Judge, sitting as a Royal Commission in Sydney, after taking evidence at great length as to costs, fixed a standard price of 4s. 8d. per 1000 c.ft. for the Sydney gas companies, and a proclamation to this effect was issued; but the companies gave the Government an undertaking that they would not charge, without further consultation, more than 4s. 5d. As the difference in freight on coal between Sydney and Melbourne was about 4d. per 1000 c.ft., it was clear that, taking the cost of coal into consideration, their own Company, in supplying gas at 4s. 7d., were selling it at 2d. per 1000 c.ft. less than was being charged in Sydney. Whereas the price of gas in Sydney had been thus increased from 3s. 9d., before the war, to 4s. 5d. per 1000 c.ft., the price in Melbourne had only gone from 4s. 4½d. to 4s. 7d. Though the average number of complaints, in proportion to the number of meters, was no greater than it had been for years, an agitation had been fomented which caused the Government to appoint a Commission to inquire as to whether the Company had supplied gas of the standard prescribed by their Act, and also to decide the purely technical question as to what standards should, in the opinion of the Commission, be adopted when any future standards were being fixed. The case was still *sub judice*. Should present conditions continue, Melbourne and the suburbs served by the Company must run short of gas unless immediate action were taken to erect new works on a large area; and the Directors were by no means sure that even this would, in present circumstances, save the situation. This, he said, would not come as a surprise to the shareholders, who had on previous occasions been made fully acquainted with the strong efforts of the Directors ever since the sitting of the Gas Inquiry Board in 1912. After again going over the matter, he declared that, if Parliament refused to pass a short Act, giving power to the Company to raise sufficient capital to carry on a public utility undertaking, and giving them the right to buy from the Government the only piece of land suitable for the purpose, and the community as a consequence were unable to obtain gas, the Company must be freed from all blame.

The motion for the adoption of the report and balance-sheet was carried unanimously, and a dividend of 6s. 6d. per share was declared out of the profits for the half year.

Diminishing Coal Stocks at Brighouse.—Speaking on the prospects of street lighting at Brighouse during the winter, Mr. J. F. Bottomley told the Town Council that the position at the gas-works was somewhat critical, as they had 1000 tons of coal less than at the corresponding period last year. As much gas was used for industrial purposes, he urged still greater economy in lighting, though he complimented the population on their fuel saving.

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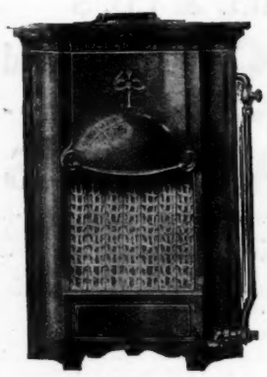

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MAXIMUM PRICES FOR SULPHURIC ACID.

An Order by the Minister of Munitions fixes, as from the 1st inst., new maximum prices for sulphuric acid, in place of those fixed by an Order dated May 10 last. [See "JOURNAL" for May 14, p. 298.] The new prices are as follows:

SCHEDULE.

MAXIMUM PRICES FOR SULPHURIC ACID.

1. Weak acid—*i.e.*, acid of all strengths up to and including 90 p.ct. H_2SO_4.

	Maximum Price per Ton	Remarks.
Class A.—Arsenical acid	88s.	For acid of 140° Tw. at 60° Fahr., with an increase or reduction of 6d. in respect of each complete degree Twaddel by which the specific gravity is more or less than 140° Tw. at 60° Fahr.
Class B.—Non-arsenical or de-arsenicated acid.	105s.	For acid of 140° Tw. at 60° Fahr., with an increase or reduction of 7d. in in respect of each complete degree Twaddel by which the specific gravity is more or less than 140° Tw. at 60° Fahr.

2. Concentrated acid—*i.e.*, acid of all strengths over 90 p.ct. H_2SO_4.

Mono-Hydrate (H_2SO_4). Content of Acid.	Maximum Price per Ton.	
	Class C. Arsenical Acid.	Class D. De-Arsenicated or Non-Arsenical Acid.
	£ s. d.	£ s. d.
Over 90 and up to 91 p.ct.	5 19 6	7 5 3
,, 91 ,, 92 ,,	6 6 0	7 12 3
,, 92 ,, 93 ,,	6 12 6	7 19 3
,, 93 ,, 93½ ,,	6 19 0	8 6 3
,, 93½ ,, 94 ,,	7 2 3	8 9 9
,, 94 ,, 94½ ,,	7 5 6	8 13 3
,, 94½ ,, 95 ,,	7 8 9	8 16 9
,, 95 ,, 95½ ,,	7 13 9	9 2 0
,, 95½ ,, 96 ,,	7 18 9	9 7 6

Over 96 p.ct. in both classes, an addition of 1s. 2d. per ton for each complete one-tenth of 1 p.ct. of additional mono-hydrate.

Certain additional charges are authorized for package, filling, and, in certain circumstances, carriage.

All communications in reference to the new Order should be made to the Director of Acid Supplies, Ministry of Munitions, Department of Explosives Supply, Storey's Gate, Westminster, S.W.1.

COMMITTEE ON PRODUCTION AWARDS.

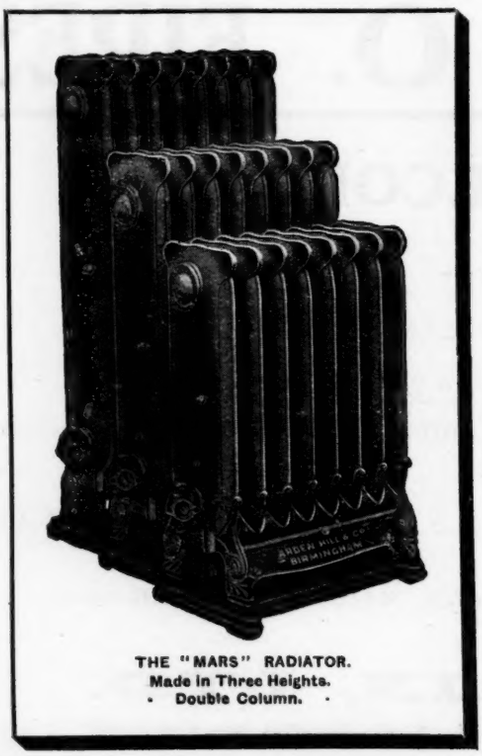
The following further award in connection with the wages of gas workers has been issued by the Committee on Production:

ALDERSHOT GAS, WATER, AND DISTRICT LIGHTING COMPANY.

The parties to the reference were the Company and the Workers' Union. The claim submitted was for the following increases in wages: Shiftmen, 2s. per shift; yardmen, 1d. per hour; lads, ½d. per hour. Representatives of the parties were heard on Oct. 1. The Company is a certified undertaking. Shift workers have received war advances amounting to 18s. per week (on a basis of six shifts) and other workers have had advances of 12s. 6d. per week, together with the bonus of 12½ p.ct. on earnings. The award of the Committee is as follows: The men concerned who are shiftmen shall receive an advance of 1s. per shift; Yardmen, aged 18 years and over, shall receive an advance of 1d. per hour; to boys and youth, under 18 years of age, there shall be paid ½d. per hour. The amounts awarded are to be taken into account in the calculation of payment for overtime or night duty, or for work on Sundays and holidays; but they are not otherwise to apply to or affect, present time rates, premium bonus rates, or piecework prices, and are not to be taken into account as part of the time rates for the purpose of fixing new piecework prices or bonus rates. The amounts awarded are to be regarded as war advances intended to assist in meeting the increased cost of living, and are to be recognized as due to, and dependent on, the existence of the abnormal conditions now prevailing in consequence of the war. The award is to take effect as from the beginning of the first full pay following Oct. 1.

BOURNEMOUTH GAS AND WATER COMPANY.

The parties to the reference were the Bournemouth Gas and Water Company and the Workers' Union. The claims submitted were: (1) That the wages be increased to £1 3s. 6d. on pre-war rates, *plus* the bonus of 12½ p.ct. (2) That the recognized number of shifts be six shifts of eight hours per shift, and any seventh shift worked be paid at the rate of double time, and that the timeworkers be placed on a forty-eight hour week. (3) That overtime be paid at the rate of time-and-a-quarter for the first two hours, time-and-a-half for the second two hours, after that double time. (4) Women.—That proper messroom, changeroom, and washing facilities be provided, with an allowance of ten minutes for changing clothes. Representatives were heard on Oct. 11. The Union and the Company were parties to the General Award (No. 1068, dated March 27, 1918) to gas workers. The men



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concerned have received the appropriate advances and the 12½ p.ct. bonus on earnings in accordance with the terms of that award. They have also received, as from Oct. 1, the 3s. 6d. per week recently agreed upon for gas workers. It was agreed that item (4) be withdrawn and submitted to the Special Arbitration Tribunal on women's wages. Item (1) had been satisfactorily met by the grant of an advance of 3s. 6d. per week as from Oct. 1. Items (2) and (3) have not been established.

ABERDARE AND ABERAMAN CONSUMERS' GAS COMPANY.

The parties to the reference were the Aberdare and Aberaman Consumers' Gas Company and the Municipal Employees' Association. The claim was for: (1) A war wage advance of 20s. a week, to be paid at the rate of 3s. 4d. a day or shift for each day or shift worked; (2) payment *pro rata* for overtime worked; (3) the application of the 12½ p.ct. bonus on earnings, the claim to include the technical and clerical staffs and foremen. Representatives of the parties were heard at Cardiff on Oct. 11. The claim applied only to male workers. At the hearing, the Company submitted a signed statement by members of the technical and clerical staffs and foremen to the effect that they were not parties to the Association's application. In these circumstances, the Association amended their claim by the deletion of the words "the claim to include the technical and clerical staffs and foremen." Under an agreement recently arrived at between certain authorities owning gas undertakings and some of the trade unions affiliated to the National Federation of General Workers, gas workers employed in such undertakings are to receive a further advance of 3s. 6d. a week. The award of the Committee was as follows: Having regard to the foregoing agreement, the men concerned shall receive an advance of 3s. 6d. a week, payable at the rate of 7d. a day or shift for each day or shift worked, and, in addition, they shall receive a further advance of 2s. per week, payable at the rate of 4d. a day or shift for each day or shift worked. The advance awarded is to be taken into account in the calculation of payment for overtime and night duty and for work on Sundays and holidays (in cases in which extra payment is made for such work); it is to be regarded as a war advance; and is to be recognized as being due to and dependent on the existence of the abnormal conditions prevailing in consequence of the war. This award shall take effect from the beginning of the first full pay after Oct. 16.

Maximum Price at Chelmsford.—The Gas Committee of the Chelmsford Town Council have considered the advisability of seeking an Order to modify their Act with respect to maximum gas charges. The Committee state that the prices at present charged for gas are the maximum authorized to be charged; and having regard to the continued heavy increases in the cost of labour and materials, they are of opinion that, unless the Council obtain the necessary statutory authority to increase the price, it will be impossible to carry on the undertaking except at a loss. The Committee therefore recommend that an application be made to the Local Government Board for an Order.

FUEL ECONOMY IN THE HOME.

The last of his series of three lectures, on the "Principles of Fuel Economy in the Home" [*ante*, pp. 137, 199], was delivered on Wednesday, Oct. 23, by Mr. A. H. Barker, B.Sc., B.A., Wh.Sc., Lecturer in Heating and Ventilating Engineering, at University College, Gower Street, W.C. In this he considered more particularly the means whereby economies in room warming might conceivably be effected on theoretical grounds or can be effected in practice, and the methods by which the best results can be obtained from apparatus at present in actual use.

A number of very valuable experiments have, the lecturer said, been carried out during the last two years at the School of Technology in Manchester, by Mrs. Fishenden, who is co-operating with him in an endeavour to solve some of the problems connected with radiant heating. These experiments show that the general efficiency of a good modern open fire using coal is about 25 p.ct.; while with a straight-backed fire of the old type the proportion is about 21 p.ct. The loss in the chimney flue varies from 12½ to 60 p.ct., according to the draught conditions. Generally it varies between 30 and 60 p.ct.; but portions of the heat produced by combustion of the fuel are lost by conduction to the walls and brickwork. Experiments have also been made with coke, tarless fuel, coalite, and briquettes. Generally speaking, the radiant efficiency is slightly greater for all such fuels than it is for coal—reaching about 35 p.ct. as a maximum. That is to say, roughly speaking one-third of the total heat in such fuels as coalite may come into the room, with a corresponding reduction in the losses. Wet coke has a much smaller efficiency than dry coke. The question whether, and to what extent, coke is a useful material for open fires, depends partly on its quality and partly on its dryness. Some coke at present contains a large proportion of rubbish, which results, when an attempt is made to burn it, in a tremendous quantity of dust and clinker; and another thing is that coke is stored in heaps, exposed to the open air. When coke is good and dry, it has a slightly greater efficiency than has coal when used in an open fire—meaning by efficiency the proportion of the total heat in the fuel which goes out into the room as radiant heat. The householder should arrange for the coke to be dried, as far as is possible, before it is put on the fire; and coke should always be kept in a dry place, with no rain falling upon it. Even so, a great many kitchen ranges will not heat adequately with coke as fuel. A room on a cold day heated by an open fire commonly contains air which is too cold for comfort. It is only possible to be nicely warm when sitting somewhere near the fire. He made a proposal whereby the heat of the fire could be communicated to a suitably designed iron mantelpiece which would contain water-spaces for taking up the waste heat of the fire and communicating it to the air of the room.

One other point in this connection to which reference ought to be made, said Mr. Barker, was the question of the extent to which the

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appearance of warmth in an open fire has an effective influence on its utility. There can be no doubt that the warm appearance of an open fire goes a long way towards producing a feeling of warmth in the room. Mr. Berry, an electrical engineer, has invented an apparatus which produces a very close approximation to the appearance of heat without the warmth. It has the look of a blazing open fire, including even the flicker; but no heat at all proceeds from it. In spite of this fact, any person standing in front of the fire without being informed what it is, can feel warmth which does not really exist. If a room is properly warmed by radiators, and if at the same time an apparatus of this kind is introduced into the fireplace of the room, it would not be surprising to find that the combination met the objection of a great many people to sitting in a room without an open fire. The cost of maintaining such an arrangement is insignificant.

The only practical way of making a room warm without incurring expense is to reduce the ventilation. Without advocating undue reduction of ventilation, it may be remembered that any room provided with an open fire and a chimney flue has probably an amount of ventilation far in excess of the requirements of any occupants, even though all the doors and windows are closed. The easiest method of restricting the amount of air passing through a room is to check the chimney draught by means of a register or damper in the flue, or by building-up fire-clay slabs over part of the opening. The next method of securing economy is to reduce the fuel consumption, to secure as much radiation as possible from the fire, and to prevent the heat from being wasted. It is necessary carefully to distinguish between two aspects of fuel economy. The first general principle for increasing the economy of fuel is, of course, to refrain from burning too much. The other principle is to secure the maximum result from the amount that is burnt. These two principles should never be confused. The effect aimed at in radiant heating is that of direct heating. The object is not primarily to make the whole of the contents of the room warm, but to produce instantaneously conditions which are tolerable for a person occupying the room, even though the air, the furniture, and other things in the room are cold. It takes many hours for a system of heating thoroughly to warm up the cold air and furniture of a room. With any method of rapidly introducing radiant heat into a room—such, for instance, as a gas-fire or electric heater, which can attain its maximum heat in a few minutes—the conditions in a perfectly cold room can very soon be rendered tolerable; but with a coal-fire the time is much longer—say, an hour. Much of the heat which goes in an upward direction is for practical purposes lost; and therefore grates should be so designed that they throw the heat downwards—the back of the fire should slope forward as much as possible. But whatever is done, one cannot prevent the greater portion of the heat from an open fire being projected upwards. A gas-fire is more efficient than a coal-fire in the sense that the radiation is mainly horizontal, and not inclined upwards. It may generally be said that a fire the burning of which has the effect of making the chimney-piece and the ironwork all round hot, is a much more effective fire from the point of view of warming than one which leaves all surroundings cold. Any device, therefore, that can be adopted which will result in the surroundings of the fire becoming hot by conduction, is to be commended.

Considering the question of increasing in a practical manner as far as may be the radiant efficiency of a fire, Mr. Barker said nothing much can be done to improve the efficiency of a gas-fire as supplied by the makers. The amount of heat radiated by a gas-fire depends almost entirely on the degree of knowledge expended on its design; and much attention has been given to this matter by the makers, and great improvements made. A method of room heating by gas devised by him consists of a ring of burners with luminous flames, which burn underneath a sort of canopy, partly of fire-brick, and partly of a metal surface (preferably of a reflecting character), which reflects all the radiant heat downwards on to the floor in the space surrounding the burners. The burners should be on as low a level as is consistent with safety; and underneath them there should be a kind of tray. This tray, besides catching any hot particles falling from the fire-clay, will also have the effect of thoroughly mixing the hot products of combustion with cold air, and thereby cooling them to such a degree that they will not rise straight to the ceiling, but will tend to warm the whole of the air of the room. A device of this kind placed under the breakfast table on a cold morning will keep the persons sitting round quite warm with a very small consumption of gas. In the case of a gas-oven, if the outlet at the top has no damper, or some means of checking, one should be contrived. An improvement in the economy of the oven can also often be effected by means of a fire-clay slab, placed inside the oven in such a way that the flames impinge upon it before getting into the oven. Once the slab is hot, the gas may be turned out, and the oven will remain heated for a considerable period, especially if the outlet is then entirely closed. Great economies may be effected in connection with boiling and heating vessels placed on a gas-ring, by surrounding the vessels with a jacket which excludes cold air, and keeps the products of combustion in close contact with the object itself. There is no complete remedy for the waste of heat for which the gas-cooker hot-plate is generally responsible, except a complete transformation of the principle on which the hot-plate is constructed; and this is out of question at the present time.

Mr. Barker concluded his lecture with a demonstration of the effects of the jacket to which he had referred, fitted to a kettle of water placed on a gas-ring.

New Fuel Inspectors.—Hotels, hospitals, public baths, and other non-industrial establishments, come under the Household Fuel and Lighting Order; but as their circumstances differ from those of the ordinary household, it has been decided to apply separate treatment to secure economy. Accordingly, engineers of the Technical Department of the Coal Control will be appointed inspectors, and will act for the Local Fuel Overseers. They will consult with the heads of establishments as to the best means of cutting-down light and fuel consumption, while maintaining a proper standard of comfort and efficiency.

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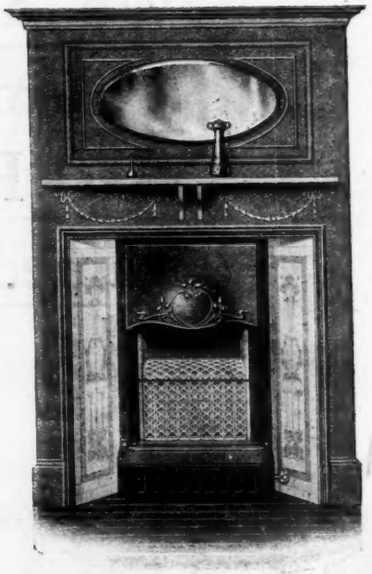

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CURRENT SALES OF GAS PRODUCTS.

The London Market for Tar, Tar Products, and Sulphate.

LONDON, *Nov.* 4.

Pitch maintains its firm tone, the price being steady at not below 65s. per ton net in bulk at makers' works. The article is in strong demand and shipments are being made regularly. Solvent naphtha is steady at about 3s. 9d. per gallon net. Creosote and other tar oils are without change.

Sulphate of ammonia continues in good demand, on the Government terms.

Tar Products in the Provinces.

Nov. 4.

The average values for gas-works products during the week were: Gas-works coal tar, 30s. 6d. to 35s. 6d. Pitch, East Coast, 44s. to 45s. per ton; West Coast—Manchester 35s. to 40s., Liverpool 35s. to 40s., Clyde 35s. to 40s. nominal. Benzol 90 p.ct., North, 10½d. to 11½d.; 50-90 p.ct., naked, North, 1s. 3d. to 1s. 4d. Toluol, naked, North, 2s. 3d. Coal tar crude naphtha in bulk, North, 7⅞d. to 8¼d. Solvent Naphtha, naked, North, 2s. 11d. to 3s. Heavy naphtha, North, 2s. 11d. to 3s. Creosote, in bulk, North, 4¼d. Heavy oils, in bulk, North, 5d. Carbolic acid, 60 p.ct. East and West Coasts, 3s. 6d. naked, nominal. Naphthalene, £25 to £30; salts, £6 to £7, bags included. Anthracene, "A" quality, 4d. to 6d. per minimum 40 p.ct.; "B" quality, 1½d. to 2d.

FROM A MARKET CORRESPONDENT.

Tar Products.

Market conditions have undergone very little change since my last report. London pitch is steady around 65s. So far no difficulties have come to light as the result of this product being placed in Class "B," instead of Class "C," for export. In the Provinces, prices remain firm with holders very unwilling to accept under 40s. per ton, which is the fixed official price for pitch taken for blending with creosote oils for fuel. The demand for tar is increasing; and the Road Board will have to provide for some very heavy calls next year. The tar purchase proposals are still coming in for a good deal of criticism, especially with reference to the ten-years period. Even with a five-year agreement, smaller producers will doubtless follow the former policy of those works which wisely reserved the right to acquire the distillers' plant at the end of the contract period. Generally, however, it would seem that if producers of tar wish to secure the best results in the future they will provide either for their own plant or co-operate with others in the acquisition of works. Solvent naphtha continues in moderate request, and there seems very little ground for anticipating any falling off in this respect with the cessation of hostilities—in fact, the coming of peace, and the gradual re-establishment of normal conditions in the rubber industry, together with the expansion in that industry which is certain to come along as the result of the many successful uses to which rubber has been put in war, should all combine to create an increased demand for solvent naphtha. The heavy variety is just steady at late rates. The demand for crude naphthalene continues strong, and quotations are slightly harder. Trade in refined, however, is rather poor, and flake makes only £28 per ton. Carbolic acid remains without alteration, and cresylic acid is slightly higher in price. Other products are unchanged. The range of quotations is as follows:

Benzol: 90% London, 1s. 0½d., North 10½d. to 11½d.; 50% North 1s. 4d. to 1s. 5d. naked per gallon.

Carbolic Acid: 60% East and West Coast 3s. per gallon; crystals 40% 1s. 8d. to 2s. per lb.

Crude Tar: London 39s. to 41s.; Midlands 33s. to 35s.; North 32s. to 34s. per ton *ex* works.

Pitch: London 65s. per ton f.o.b. works; East Coast, 36s. 6d. to 37s. 6d.; West Coast, 37s. 6d. to 40s. f.a.s.; Manchester, 39s.; Clyde, 41s.; South Wales, 45s. per ton.

Solvent Naphtha: London 3s. 3d. to 4s.; North and Midlands 3s. to 3s. 6d. per gallon.

Crude Naphtha: Naked 30% 8¼d. to 8½d.; North 6½d. to 6¾d.

Naphthalene: Refined £28 per ton nominal; salts 80s., bags included.

Toluol: Naked, London 2s. 4d.; North 2s. 3d.

Creosote: Nominal, London 4¼d.; North 4d. to 4¼d. (Government price, 75s. per ton f.o.b.—equal to 4⅜d. per gallon); heavy oil, 4½d. per gallon in bulk.

Anthracene: "A" quality, 40-45%, 4½d. per unit; "B" quality, 1¾d. to 2¼d.

Cresylic Acid: 95%, 3s. per gallon; 97-99%, 3s. 3d. to 3s. 6d. per gallon, casks included, *ex* works London and f.o.b. other ports.

Grease Oils 18° Tw. (naked) £6 per ton f.o.r. makers' works.

Sulphate of Ammonia.

There is no change in the situation, except that the proximity of the cessation of hostilities opens up a very interesting phase for the trade; for if we are to regain what we still hopefully look upon as temporarily, and not permanently, lost, German moves must be anticipated and countered. Our export trade in this product before the war was of sufficient importance to justify the close attention of our manufacturers; but as yet, it is disheartening to find that very little effort is being made to regain our former position.

Constables Thos. Kyle and Thos. Durant were accidentally gassed at the Greencastle Barracks, near Belfast, where they were stationed. The first-named died without regaining consciousness; but Constable Durant has made favourable progress towards recovery.

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Keeping within the Gas Ration.—On a recent occasion when the gas rations were on the point of being exceeded at the London County Council offices, Spring Gardens, the whole supply was, says the "Evening Standard," cut off, with the result that the canteen had to be closed, and no meals were obtainable in the building. This drastic cure had an immediate effect.

Street Lighting in Bradford.—In the Bradford City Council last week, better street lighting was strongly advocated. Mr. J. H. Barraclough (the Chairman of the Gas Committee) said it was not a matter of who was responsible, but a fact that if half-a-dozen extra lights were to be put in the city the coal supplies would be seriously reduced. He was told that Bradford was already exceeding its share of light. He could not say all he would like to do, and asked the Council to trust him. The fuel situation was not fully realized, though in regard to coal supplies Bradford at present was as well placed as any city in the country.

The Incandescent Mantle Business in Germany.—According to the "Ironmonger," the report of the Deutsche Gasglühlicht (Auer) Company of Berlin for 1917-18 showed a gross profit of 27,219,000 m. (25,441,000 m. in 1916); but the working expenses increased from 10,116,000 m. to 19,833,000 m. The rise in gross profit is due to increased turnover; but the net profit is only 6,851,000 m.—the decline being partly due to the decreased percentage of gain on Army contracts. The dividend is 25 p.ct., as in the previous year. A special reserve of 4,500,000 m. has been created, and 1,610,000 m. is carried forward.

Mond Gas Supply in the Midlands.—At last week's meeting of the Walsall Chamber of Commerce, it was reported that the manufacturers of Walsall, Wolverhampton, and the adjacent districts had been considering representations which had been made by the Mond Gas Company to the effect that they would have to close-down their works unless they were provided with an adequate supply of slack. The position was so serious that strong representations were at once made to the Coal Controller, from whom a reply had since been received to the effect that certain collieries had been instructed to see that the Company's requirements as regarded fuel were met. Military labour had also been provided so as to maintain the output of gas.

A Strike at Pontefract.—The Pontefract Corporation employees are on strike, demanding an extra 10s. per week on top of the 15s. above pre-war rates which they are already receiving. On the occasion of the last recent advance an agreement was prepared, but not signed. The Corporation contend that the men did not sign because the Corporation would not compel four men to join the Union; but the men say they did not sign because they consider three months' notice of any request for variation, as provided in the agreement, too long. The Corporation are now prepared to pay the 10s. from Nov. 15—two months, instead of three, from the receipt of application for the increase; but the men insist on payment from the time of resumption. The matter has been put before the Board of Trade.

Wexford Gas-Works Strike.—A strike of gas-works firemen and labourers for shorter hours, led to a suspension during last week of the gas supply in Wexford, causing serious public inconvenience; but at the week-end an arrangement had been come to which enabled the works to be re-opened.

Shaded Lights Cause Waste of Gas.—On the motion of the Cleaning and Lighting Committee of the Edinburgh Corporation, the Town Council have decided to petition the Secretary for Scotland to rescind the clauses in the Lights (Scotland) Order which provide that in dwelling-houses, hotels, shops, and other premises of all descriptions, all inside lights must be so reduced and shaded that no more than a dull, subdued light is visible from any direction outside, and no part of the pavement or roadway or any building or other object is distinctly illuminated thereby. The Convener of the Committee (Judge Stark) pointed out that the Coal Controller had asked them to economize in lighting, and the one Order was inconsistent with the other. Judge Stark had visited the previous night a shop in which there were ten lights, all screened; while three open lights would have given a better result.

Increased Gas Consumption at Bradford.—Returns got out recently show that the consumption of gas in Bradford has increased by comparison with last year—a fact which has been particularly noted by contrast with the conditions at Leeds and other places, where reductions are recorded. One explanation suggested among the public is that more gas is having to be used to obtain the same results, owing to its poor quality; but the better explanation is that householders have been encouraged to use gas rather than coal or electricity, in order to increase the output of bye-products. At the same time, it is reported that no appreciable reduction in electricity has occurred. At several local works gas-furnaces have been installed recently; and as the accounts show a distinction between power and other uses, but not between lighting and heating, it is likely that these new furnaces have a good deal to do with the increased consumption apart from power.

Alleged Pollution of a Brewery Well.—For some time the Edinburgh and Leith Gas Commissioners have been in negotiation with Messrs. W. Younger & Co., Ltd., of Edinburgh, with regard to the alleged pollution of a well at their Holyrood Brewery, by contaminated water from the site of the old Edinburgh Gas-Works. [See "JOURNAL" for Oct. 2, 1917, p. 35.] The points in dispute have now been settled on the following terms: The Commissioners, without any admission of liability, (1) to carry out any operations within their own property that their engineers might advise as expedient for the cleansing of the gas-works site; (2) to pay the Company £2000 in full discharge of the expenses incurred, and to be incurred, by them in carrying out remedial measures within their property; and (3) to pay them £50 a year for pumping Wilson's Court well until the disappearance of pollution, as well as £450 for the purchase of the necessary pump and installation thereof—the Company to purchase and instal the pump, and have it regularly worked.

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Reading Gas-Works War Savings Association.—The membership of the War Savings Association in connection with the works of the Reading Gas Company is now 170, compared with 25 at the first meeting; and the total subscriptions received from the commencement of the Association up to Sept. 30 amount to £894. In the report of the Committee for the past twelve months, thanks are tendered to the Gas Company for a donation of £25.

Belfast Gas Accounts.—The accounts of the Belfast Corporation for 1917-18 showed a profit for the gas-works (on a revenue of £484,000) of £27,185; and the cost of the general lighting of the city was stated at £19,000, as against £17,000 in 1916-17. The cost in the current year will be much higher, it is understood, owing to the repeated increases of war wages and the continued advance in the price of materials—and this notwithstanding the severe economies entailed in all sections of the community by lighting restrictions.

Irish Lighting Restrictions.—The Irish Lighting Restrictions Order, as finally issued, does not provide for the prohibition, as anticipated, of window lighting and outdoor lighting of premises, nor does it provide for diminished lighting in private houses, hotels, clubs, &c. But, as a matter of fact, these forms of lighting have been considerably reduced—and, indeed, in Dublin, Belfast, and other large centres, window lighting and lighting outside premises has been abolished, while shop lighting generally where opening is allowed after 5.30 p.m., has been greatly reduced. The result is that, with the drastic reduction of public lighting, the cities and towns are now in semi-darkness. The early closing regulations have badly hit the smaller shopkeepers, who are substantial users of gas; and many complaints have been formulated for the Coal Controller's consideration. It is hoped that, with the improvement in the war situation, better coal supplies will be available at least by the close of the year. The Order, however, remains in operation until the end of March next.

Sheffield Gas Consumers' Association.—Mr. William Clark (the President) told the members of the Sheffield Gas Consumers' Association, at a meeting recently, that there is every prospect of a considerable improvement in the gas supply during the coming winter. Mr. Hanbury Thomas had written informing him that the repairs of the gasholder at Grimesthorpe were completed; and the holder had been in use during the last little while. They were experimenting under the direction of the Ministry of Munitions with the employment of women in a retort-house at Neepsend. The general repairs were being proceeded with, but not as quickly as they should wish. They had not, therefore, been able to obtain as good a pressure of gas as they should ordinarily desire to do. They, however, hoped that before long matters would improve in this respect. With regard to the supply of gas during the coming winter, the Company had every reason to believe they would be able to meet the requirements of the large consumers, more especially as, owing to the Fuel and Lighting Order, the demand for gas for private consumption is likely to be curtailed. They were, the letter concluded, at present experiencing a very considerable reduction in this direction.

Gas Economy in London.—"The Times" says that, owing to the appeal to save light and fuel, the returns of several typical gas companies in the Metropolitan area show decreases ranging from 2 p.ct. to nearly 10 p.ct. The measure of saving varies according to district. In the South London area, the reduction on the past quarter is 9·5 p.ct., compared with the corresponding period of last year. In the industrial East End, where the bulk of the consumption is in factories and munition works, and where domestic supply is on the penny-in-the-slot basis, the reduction is 2 p.ct. Wandsworth shows a reduction of 8·3 p.ct., Epsom of 11·5 p.ct., and Mitcham of 5·6 p.ct.

Less Light for Hotels and Shops.—A further reduction has been decided upon by the Coal Controller in the lighting allowances in hotels, restaurants, and large shops in London and the big provincial towns; so that all extravagant display of lighting or excessive illumination in the nature of advertising or attraction shall be dispensed with. Observation of the result of rationing their lighting supplies has convinced the Controller that in many cases further economies can be made. Therefore he proposes to reduce their lighting by a further 25 p.ct., subject to the consideration of any special circumstances. Representatives of the leading London stores have met, and agreed that, as from the 11th inst., they will endeavour to reduce the amount of illumination in shop premises open to the public to one-half the number of lamps in use in 1917.

The Primitiva Gas Company's Position.—On Monday last week, the "City Notes" in the "Evening Standard" contained the following: War taxation has created a taste for deferred hopes. Confessedly it is not patriotism; and it cannot be denied that, as the hopes frequently blossom less luxuriantly than expected, an extra risk is entailed. The quiet demand for the preference shares of the Primitiva Gas Company of Buenos Ayres is actuated by what may happen after the war. War influences, aggravated by domestic troubles of German origin (the rival electric undertaking being German owned), have produced misfortune. The £5 cumulative 5 p.ct. preference shares last received a dividend up to the end of 1915; so that the present price of 3¾ includes arrears of 15s. Before dividend payments are practicable, the arrears may be substantially larger. The Municipality, be it clearly understood, is still intentionally ignoring the arbitrator's award of a higher scale of charges. Its behaviour in this respect is unworthy of such a great city. Moreover, it will not settle the debt to the Company, which reached £133,500 at the end of 1917, and is now considerably larger. With coal supplies totally inadequate, operations are conducted under the greatest difficulty—wood and even cereals being requisitioned. These physical obstacles are serious; and the German machinations are equally weighty. But the latter are not being accepted without counter-measures; and it is conceivable that in the end the Huns, backed by the three big banks, may not prove victorious. It is scarcely credible that the Argentine Government will be permitted to flout the Company and its just claims. The undertaking, in spite of what it has had to put up with, is not a weakling, as the ordinary £5 shares are commanding up to 45s.

SAWER & PURVES,

THE POSITIVE DRY PREPAYMENT METER

MANCHESTER & NOTTINGHAM.

Ceara Gas Company.—At the annual meeting on Friday, the Directors will report that the year's working has resulted in a credit to the revenue of £94. The balance is now £548, which is carried forward. Business in Ceara has somewhat improved, but is still retarded by lack of transport.

Fears of Electricity Supply Proposals.—When moving at a meeting of the Newcastle City Council the adoption of a report from the Parliamentary Committee dealing with the question of electricity supply, the Lord Mayor (Sir George Lunn) said the Coal Conservation Sub-Committee appointed by the Board of Trade had issued certain proposals in regard to electricity supply, which the Parliamentary Committee considered were dangerous to the public interest. If the proposals were put in operation, a Trust would be able to take over all municipal plant and undertakings. The Committee considered that, if there were to be such Trusts, they should be under popular local control. A series of conferences had been held with other North-East Coast municipalities owning electric undertakings; and a statement had been drawn up asking that the Government should only act after an exhaustive inquiry, at which the municipalities should be represented.

Land-girls are doing stoking work at the Driffield Gas-Works, owing to shortage of male labour.

Mr. W. B. M'Lusky, the Gas Engineer of the Halifax Corporation, lectured recently to the Yorkshire Managers' and Overlookers' Society, on "How to Make the Most of the Fuel Ration," demonstrating and explaining the many uses to which gas can be put. He laid special emphasis on the necessity of keeping all appliances and utensils clean. He showed the advantages of gas heating over raw coal. The lecture was a sequel to a visit to the gas-works, a few days previously, by the members of the Society.

At a recent inquest at Bradford, a verdict of "Accidental poisoning due to coal gas" was returned in the case of Wm. Parkinson, wool warehouseman, of Boldshay Street, who was found unconscious with the gas turned on. The crevices in the room were not stopped up. The gas-tap was found to be loose. Deceased had shown no disposition to destroy himself, and was in fairly good health, though feeble. A Belfast Coroner's July returned a verdict of death from gas poisoning, in the case of John Grainger, who had retired to bed leaving the gas partly turned on.

At a meeting of the Bradford City Council last week, Mr. C. A. Glyde suggested that as the Gas Engineer (Mr. Charles Wood) was giving valuable services to the Government, some of his expenses should be paid by the Government, instead of them all falling on the Corporation. Mr. J. H. Barraclough (the Chairman of the Gas Committee) said the work which was being done by Mr. Wood, when it was properly realized, would be something of which every member of the Corporation would be proud. There were no expenses put down for the work he did for the Government.

The scarcity and high price of matches has brought about a huge demand for automatic lighters, both for pocket and household use. In spite of the fact that many manufacturers are engaged in making these lighters, there is still a considerable deficiency, to a certain extent occasioned no doubt by the difficulty of obtaining supplies of pyrophoric alloy (cerium metal). This difficulty can now be superseded, as we understand that Messrs. Paul Winn & Co., Ltd., of 72, Mark Lane, E.C.3, the agents of the Lindsay Light Company, are able to offer regular supplies for prompt shipment from the United States. Their product is shipped so as to arrive free from oxidation.

Since its introduction a few years ago as a novelty, the portable electric torch has won for itself a position of almost indispensablity. In these days of lighting restrictions, there are few industries in which this handy and useful device does not find a place. Recognizing the extent to which gas undertakings have adopted the electric torch for various purposes—for the use of night watchmen, for meter reading, breakdowns, &c.—British Utilities, Ltd., of Wandle Bank, Wimbledon, S.W., are making a speciality of dispatching weekly to gas-works throughout the Kingdom their special dry batteries for portable torches and inspection lamps. Already, we understand, they have quite a number of gas undertakings to whom they are making regular deliveries.

APPLICATIONS FOR PATENTS.

[Extracted from the "Official List" for Oct. 30.]

Nos. 17,127—17,517.

Calvert, G.—"Production of cyanogen compounds, ammonia, &c." No. 17,167.
Johnston, J.—"Rotary compressors or exhausters." No. 17,467.
Lang, E. H.—"Heating boilers by acetylene." No. 17,330.
Love, W.—"Stopcocks or valves for liquid or gas." No. 17,458.
Wright, C. A.—"System of gas heating." No. 17,461.

NEWSPAPERS FOR NEUTRAL COUNTRIES.

The Secretary of the War Office has issued the following order:

> The public are informed that newspapers and other printed publications will not be sent to Neutral Countries unless they are posted direct from the office of publishers or newsagents who have obtained permission from the War Office for this purpose. Persons desiring to send newspapers, &c., to Neutral Countries should, therefore, give their orders for execution to publishers or newsagents who have obtained such permission.

The Publisher of the "Journal" has obtained the required permission of the War Office; and he will, on receipt of instructions, forward copies direct from the office to any neutral country.

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of advantage from the many found in our Slot Meters are:

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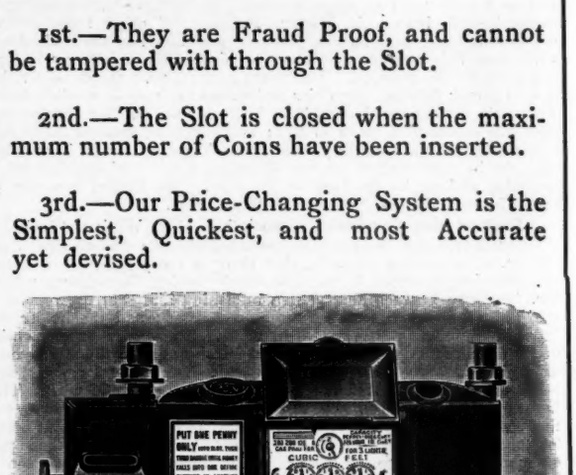

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Sulphate of Ammonia Association Prize Competitions.—There was an exhibition last week at the Horseferry Road, by the Sulphate of Ammonia Association, of samples of agricultural produce representing prize-winning crops in their competitions. In the Cereal and Root Crop Competition, there were seventeen prizes awarded, of from £50 to £1; the final judges being Messrs. R. J. Read and J. Ainscough. There were 47 counties represented in the competition, and 634 entries. In the Allotment Holders' Competition, there were ten prizes, consisting of War Bond certificates varying in value from £25 to £5. The final judge was Mr. Charles Ritchings, who reported on the most excellent standard of the plots shown. The competitions were altogether a success.

STOCK MARKET REPORT.

THE Stock Exchange had only four days of business last week; the 1st of November being annually a closed day according to custom. Business was, on the whole, at reduced pressure, though on Thursday it was beginning to show promise of renewed activity. But the general tone was very good throughout, as indeed it could scarcely fail to be in such a week of triumph—three enemy States surrendering at discretion, and the fourth writhing almost at its last gasp.

The gilt-edged market was in excellent form. Home Government issues advanced steadily day by day; Consols concluding with a mark of 61, and the 5 p.ct. Loan touching 94½ *ex div.* There was also a good demand for Indians. Home Rails also were very firm; anticipations regarding the future position being favourable. Canadians were quiet; but Argentines were more active, and improved.

The Foreign Market showed rather more animation than in the week before, and the general tendency was satisfactory. French Loans were consistently firm, and showed improved figures, Japanese were steady, and there was a renewed inquiry for Russians. In the Miscellaneous group, there were many ups and downs.

Business in the Gas Market was a good deal quieter than in the previous week—almost languid by comparison. Not half-a-score of undertakings were touched at all, and in several of these the transactions were scanty. The big issues were, comparatively speaking, neglected. For instance, Gas Light and Coke and Imperial Continental together totalled only as many bargains as Primitiva alone. But in spite of this, the tendency was quite firm generally; only Gas Light ordinary dropping one point off its recent smart rise. The quotations of Brentford debenture, South Suburban debenture, European, and San Paulo preference advanced. Cape Town preference was quoted *ex* account of arrears.

Bargains done for cash during the week were as follows: On Monday, Bombay 5½, Commercial 3½ p.ct. 60, Gas Light ordinary 73½, 74, 74¼, 74½, Imperial Continental 126, 127, 127½, Primitiva 45s., 46s. 3d., ditto preference 70s. 11¼d., 71s., 71s. 3d., South Metropolitan 75½, 75¾, 76, Bristol 4 p.ct. debenture 69¼. On Tuesday, Alliance and Dublin 52, 52½, 52⅞, Gas Light ordinary 73½, 74¼, 74½, Imperial Continental 126, 127, 127¼, 128, Primitiva 46s., 46s. 10½d., ditto preference 70s., 70s. 7¼d., 71s. 3d., South Metropolitan 75½, 75¾, 76, 76½, South Suburban debenture 84. On Wednesday, Alliance and Dublin 52⅞, Brentford "A" 79½, ditto debenture 64, Commercial 4 p.ct. 63, Gas Light ordinary 73½, 74, Imperial Continental 127, 127¼, 127½, 128, Primitiva 46s. 3d., 47s., 47s. 6d., ditto preference 70s. 7½d., 71s. 3d., 71s. 10½d., 72s. 6d., South Metropolitan 76½. On Thursday, Brentford debenture 65, Gas Light ordinary 73⅞, 74, 74¼, ditto maximum 55, Imperial Continental 126, 126½, 127¼, 127½, Primitiva 45s., 46s. 3d., ditto preference 72s. 6d., 75s., South Metropolitan 75¾, 76, 76½, South Suburban 71½, ditto debenture 85¼. The London Stock Exchange was closed on Friday.

In the Money Market, the strong demand continued up to the end of the month at firm rates. The Bank rate is 5 p.ct., as fixed on April 5, 1917.

ANTE-WAR PRICES AND DIVIDENDS, LATEST DIVIDENDS, AND LAST WEEK'S BARGAINS.

Issue. £	Share.	When ex-Dividend.	Ante-War Dividend & Bonus p.c.	Last Dividend.	NAME.	Closing Prices, July 30, 1914.	Present Prices.	Lowest and Highest Prices of Bargains.
182,049	Stk.	Mar. 10	4	4%	Aldershot 4 p.c. Pref.	..	55—60	..
1,551,868	"	April 8	2½	4⅜	Alliance & Dublin Ord.	59—64	61—56	52—52⅞
874,000	"	July 10	4	4%	Do. 4 p.c. Deb.	76—79	62—67	..
280,000	5	April 29	7½	8%	Bombay, Ltd.	5⅞—6⅛	5—5½	5⅜
60,000	10	Feb. 26	16	11%	Bournemouth Gas and Water { 10 p.c.	29—30	21—23	..
868,110	10	"	7	7%	B 7 p.c.	15—15½	10—11	..
115,000	10	"	6	6/-	Pref. 6 p.c.	13¼—14	9—9½	..
159,740	—	—	—	4%	4 p.c. Deb.	..	66—68	..
992,045	Stk.	Feb. 26	14	14%	Brentford A Consolid.	261—266	78—81	79½
734,920	"	"	11	11%	Do. B New	204—209	69—72	..
55,000	"	"	5	5%	Do. 5 p.c. Pref.	109—111	77—82	..
221,400	"	June 11	4	4%	Do. 4 p.c. Deb.	91—93	63—65	64—65
217,880	"	Feb. 26	11	8½%	Brighton & Hove Orig.	208—213	135—140	..
244,200	"	"	8	5½%	Do. A Ord. Stk.	154—159	93—98	..
680,000	20	Mar. 26	12½	22/6	British	44—45	31—32	..
120,000	Stk.	June 26	4	4%	Do. 4 p.c. Deb. Stk.	88—90	64—66	..
245,771	"	"	—	—	Buenos Aires 4 p.c. Deb.	85—87	51—54	..
100,000	10	—	—	—	Cape Town & Dis., Ltd.	1½—2½	3⅜—4½	..
100,000	10	—	—	4½%	Do. 4½ p.c. Pref.	4—6	7½—8½	..
100,000	Stk.	June 26	4½	4½%	Do. 4½ p.c. Deb. Stk.	70—75	60—65	..
157,150	"	Feb. 26	5	5%	Chester 5 p.c. Ord.	108—110	79—81	..
1,513,380	"	Feb. 12	5/9/4	36/-	Commercial 4 p.c. Stk.	106—108	60—65	63
650,000	"	"	5½	30/-	Do. 3½ p.c. do.	108—105	57—62	60
475,000	"	June 11	3	3%	Do. 3 p.c. Deb. Stk.	69½—71½	52—54	..
900,000	"	"	4	—	Continental Union Ltd.	76—79	50—58	..
300,000	"	"	7	—	Do. 7 p.c. Pref.	115—118	70—75	..
278,400	—	—	—	10½%	Croydon B and C 7 p.c.	..	140—150	..
—	—	—	—	10%	Do. E	..	..	..
492,270	Stk.	—	6	6½%	Derby Con. Stk.	123—125	95—100	..
55,000	"	—	4	4%	Do. Deb. Stk.	102—104	80—83	..
1,002,180	10	July 29	10	5/0	European, Ltd.	17½—18	15½—13½	..
16,298,975	Stk.	Feb. 10	4/17/4	59/4	Gas Light and Coke { 4 p.c. Ord.	98—102	73—75	73½—74
2,600,000	"	"	3½	3½%	3½ p.c. max.	76—79	54—56	55
4,062,235	"	"	4	4%	4 p.c. Con. Pref.	96—99	67—69	..
4,674,850	"	June 11	3	3%	3 p.c. Con. Deb.	72½—74½	54—56	..
180,000	"	"	10	10%	10 p.c. Bonds	..	..	..
958,740	"	Mar. 12	5	2½%	Hastings & St. L. 3½ p.c.	87—89	45—50	..
70,000	10	April 29	11	6%	Hongkong & China, Ltd.	16½—16¾	7—8	..
86,600	—	—	—	9½%	Hornsey 7 p.c.	..	112—117	..
131,000	Stk.	Mar. 12	7½	6½%	Ilford A and C.	151—154	90—95	..
65,780	"	"	6½	4⅜%	Do. B	115—118	69—74	..
65,500	"	June 26	4	4%	Do. 4 p.c. Deb.	92—94	62—65	..
4,940,000	"	May 14	9	4½%	Imperial Continental	150—160	125—130	126—128
1,235,000	"	Feb. 12	3½	3½%	Do. 3½ p.c. Deb. Red.	84—86	71—73	..
235,242	"	Mar. 12	6½	6½%	Lea Bridge Ord. 5 p.c.	119—121	93—98	..
2,498,905	"	Feb. 26	10	5%	Liverpool 5 p.c. Ord. { A / B	211—213 / 146—148	82—84	..
306,083	"	June 26	4	4%	Do. 4 p.c. Pr. Deb. Stk.	..	71—73	..
75,000	5	June 11	6	8%	Malta & Mediterranean	4½—4¾	3½—3⅔	..
250,000	100	April 1	4½	4½%	Met. of Melbourne 4½ p.c. Deb.	99—101	87—98	..
541,920	20	May 28	4	6/-	Monte Video, Ltd.	11½—12	8⅔—9½	..
1,875,892	Stk.	July 29	4½	3½%	Newcastle & Gateh'd Con.	98½—99½	67—69	..
539,705	"	June 26	3½	3½%	Do. 3½ p.c. Deb.	82—83	59—61	..
55,940	10	Feb. 26	7/14/0	7/-	North Middlesex 7 p.c.	14—15	9½—10½	..
800,000	Stk.	May 14	8	8%	Oriental, Ltd.	117—122	102—104	..
60,000	5	Mar. 26	10	1/-	Ottoman, Ltd.	7½—7⅞	4—5	..
60,000	50	Feb. 26	18	9%	Portsea, Island B	125—131	78—83	..
100,000	50	"	12	6%	Do. C	118—121	73—78	..
52,000	50	"	10	6%	Do. D	..	..	..
249,980	5	April 29	8	—	Primitiva Ord.	5½—6	2½—2⅝	45/—47/6
499,960	5	June 26	5	2/6	Do. 5 p.c. Pref.	4¾—5	3⅜—3⅝	70/—75/-
521,500	100	June 2	4	4%	Do. 4 p.c. Deb.	91—98	75—77	..
—	—	—	—	4%	Do. " " 1911	..	50—55	..
346,198	Stk.	June 26	4	4%	River Plate 4 p.c. Deb.	86—87	55—60	..
150,000	10	May 14	6	6/-	San Paulo { 6 p.c. Pref.	10½—11	7½—8	..
125,000	50	July 1	5	5%	5 p.c. Deb.	47—49	40—42	..
135,000	Stk.	Mar. 12	10	10%	Shanfield A	228—234	170—173	..
209,984	"	"	10	10%	Do. B	229—234	170—173	..
533,500	"	"	10	10%	Do. C	220—222	168—172	..
90,000	10	May 28	9	6/-	South African	10½—11½	11½—12½	..
6,609,895	Stk.	Feb. 10	5/4/0	32/-	South Met. 4 p.c. Ord.	111—118	75—77	75½—76½
250,000	"	July 12	—	5%	Do. Pref.	..	91—98	..
1,895,445	"	July 10	3	3%	Do. 3 p.c. Deb.	72½—74½	54—56	..
294,920	"	Feb. 26	8½	6%	South Shields Con. Stk.	157—159	118—119	..
952,795	"	"	6	3½%	S'th Suburb'n Ord. 5 p.c.	114—116	71—74	71½
60,000	"	"	5	5%	Do. 5 p.c. Pref.	110—112	73—75	..
185,000	—	—	—	3½%	Do. West Kent	..	..	..
187,558	Stk.	June 26	5	5%	Do. 5 p.c. Deb. Stk.	116—118	84—85	84—85½
647,740	"	May 14	5	3%	Southampton Ord.	99—102	68—71	..
120,000	"	Feb. 12	7½	5½%	Tottenham { A 5 p.c.	135—138	92—97	..
782,275	"	"	6	4%	B 3½ p.c.	115—117	67—69	..
181,255	"	June 26	4	4%	District { 4 p.c. Deb.	87—89	61—63	..
182,380	10	Dec. 30	5	—	Tuscan, Ltd.	5—6	1—2	..
149,900	10	July 1	5	5%	Do. 5 p.c. Deb. Red.	93—95	45—50	..
236,476	Stk.	Mar. 12	5	5%	Tynemouth 5 p.c. max.	103½—109½	87—88	..
					Wandsworth, Wimbledon, and Epsom—			
30,000	"	Feb. 26	8⅔	63/9	Wandsworth A 5 p.c.	151—156	90—95	..
255,636	"	"	6½	48/9	Do. B 3½ p.c.	129—134	70—75	..
108,075	"	"	5/17/3	44/7½	Do. C 3½ p.c.	110—115	70—75	..
852,000	"	"	6½	42/6	Wimbledon 5 p.c.	117—122	70—75	..
98,000	"	"	6⅔	48/9	Epsom 5 p.c.	121—126	72—77	..
98,416	"	June 26	3	3%	3 p.c. Deb. Stk.	68—69	49—52	..

WANTED, FOR SALE, CONTRACTS, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Appointments, &c., Vacant.

ENGINEER AND WORKS MANAGER. Cork Gas Company.

ASSISTANT ENGINEER AND MANAGER. Macclesfield Gas Department.

ASSISTANT MANAGER. Stoke-on-Trent Gas Department. Applications by Nov. 12.

ASSISTANT TO MANAGER. Leighton Buzzard Gas Company.

CONSTRUCTIONAL ENGINEER. No. 6523.

ASSISTANT ACCOUNTANT AND COLLECTOR. Nantwich Gas Department. Applications by Nov. 18.

SECOND ASSISTANT. Warrington Gas Department. Applications by Nov. 15.

Appointments, &c., Vacant (*Continued*).

JUNIOR WORKS ASSISTANT. No. 6519.

MECHANICAL FITTER. Aldershot Lighting Company.

PIPE FITTER. Aldershot Lighting Company.

MAINLAYER. Abertillery Gas and Electricity Department.

CARBONIZING FOREMAN. Barnet Gas and Water Company.

Appointments, &c., Wanted.

FOREMAN OR CHARGE HAND. No. 6522.

Plant, &c., for Sale.

IRON SHEETS. Erector, Leeds.

Meetings.

ORIENTAL GAS COMPANY. Finsbury House, Blomfield Street, E.C. Nov. 20. Twelve o'clock.

CEARÁ GAS COMPANY. 9, Queen Street Place, E.C. Nov. 8. One o'clock.

TENDERS FOR.

Fire-Clay Goods.

MANCHESTER GAS DEPARTMENT. Tenders by Nov. 14.

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No notice can be taken of anonymous communications. Whatever is intended for insertion in the "JOURNAL" must be authenticated by the name and address of the writer—not necessarily for publication, but as a proof of good faith.

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(See p. 332.)

SPENCER'S Patent Inclined HURDLE GRIDS.

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See Illustrated Advertisement, Aug 20, p. 368.

GAS-WORKS requiring Extensions should Communicate with FIRTH BLAKELEY, SONS, AND CO., LIMITED, Dewsbury, who make a Speciality of Catering for the Smaller Gas Concerns. Prices Reasonable; quality and results, the best. Satisfaction Guaranteed.

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Apply, to the SECRETARY, 72, South Mall, CORK.

REQUIRED, for an important Provincial Gas Company, an Experienced and Fully Qualified CONSTRUCTIONAL ENGINEER, with special knowledge of Modern Gas-Works Design and Coal Handling Plant. Salary appropriate to Qualifications.
Apply, by letter, giving full Particulars, to No. 6523, care of Mr. KING, 11, Bolt Court, FLEET STREET, E.C. 4.

BOROUGH OF MACCLESFIELD.
(GAS DEPARTMENT.)

APPLICATIONS are invited for the Position of ASSISTANT ENGINEER and MANAGER. Salary, £225 per Annum.
Applicants must be Qualified Chemists and Draughtsmen, and have had Experience in the Working of Continuous Vertical Retorts and Carburetted Water-Gas Plant.
Applications, accompanied by Three recent Testimonials, to be sent to the Chairman, Gas Committee, Town Hall, Macclesfield, not later than Monday, Nov. 18, and endorsed "Assistant Gas Manager."
Canvassing will be a disqualification.
By order,
F. R. OLDFIELD,
Town Clerk.
Oct. 30, 1918.

OXIDE OF IRON.
SPENT OXIDE WANTED.

BALE & CHURCH, LTD.
33, ST. MARY AT HILL, LONDON, E.C. 3.
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Tins for Sale to Consumers.
In Bulk for Works Use.

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Phone: Avenue 6680.

COUNTY BOROUGH OF STOKE-ON-TRENT.
(GAS DEPARTMENT.)

THE Gas Committee invite Applications for the Position of ASSISTANT MANAGER to Take Charge of their Fenton Works. Applicants must have had Experience in up-to-date Gas Manufacture and Distribution.
Applications, giving full Particulars of Age, Training, Experience, and Salary required, together with *copies* of not more than Three recent Testimonials, to be lodged with the undersigned on or before Tuesday, the 12th of November, 1918.
A. MACKAY,
Chief Engineer and General Manager.
Gas Offices,
Longton,
Stoke-on-Trent,
Oct. 22, 1918.

NANTWICH URBAN DISTRICT COUNCIL.

APPLICATIONS are invited for the Position of ASSISTANT ACCOUNTANT and COLLECTOR in the Council's Gas Department. Salary, £135 per Annum. Experience in Gas Accounts essential.
Applications, endorsed "Assistant," to be made on Form to be obtained from the undersigned, to be sent in not later than Monday, the 18th of November next, to
A. E. WHITTINGHAM,
Clerk to the Council.
14, Barker Street,
Nantwich,
Oct. 30, 1918.

WANTED—a Second Assistant who would be able to TAKE ENTIRE CHARGE of the Works and Capable of performing all the usual Gas-Works Tests.
Applicants to state Age, Married or Single, and give Particulars of Experience, and *copies* of recent Testimonials. Salary, £175, *plus* £26 War Bonus.
Applications to be addressed to the Chairman and received not later than Nov. 15.
WARRINGTON CORPORATION GAS DEPARTMENT, Mersey Street.

LEIGHTON BUZZARD GAS COMPANY.

WANTED—a Capable Assistant to the Manager of the above Company. Must be Experienced in up-to-date Gas-Works Routine, Manufacture, and Distribution.
Applications to be sent to MR. H. G. RUGGLES, Gas-Works, LEIGHTON BUZZARD.

JUNIOR Works Assistant required for 250 Million Works. Knowledge of Drawing, Chemistry, and usual Works Routine Testing required. Salary, £150.
Apply, giving full Particulars, to No. 6519, care of Mr. KING, 11, Bolt Court, FLEET STREET, E.C. 4.

CARBONIZING Foreman required at once. Good Capable Man, Experienced with Machine Stoking. Twelve-Hour Shifts. Wages, 75s. per Week.
Apply, giving Experience and Training, to F. J. BANCROFT, Barnet District Gas and Water Company, NEW BARNET.

WANTED — a Mechanical Fitter. Maintenance of Plant in a Modern Gas-Works.
State Wages required, with Experience, to D. RITCHIE, Manager, Ash Road Gas-Works, ALDERSHOT.